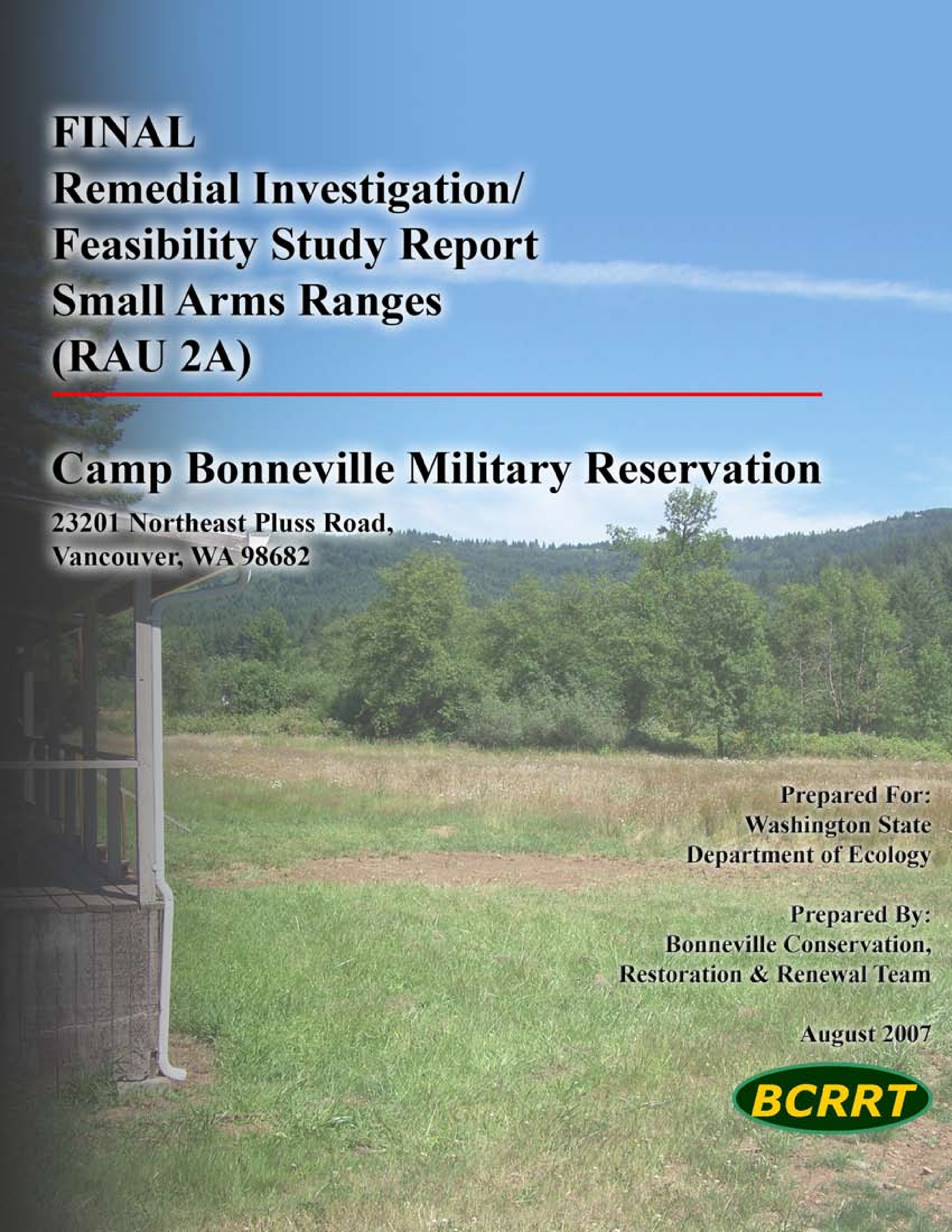

FINAL
Remedial Investigation/ Feasibility Study Report Small Arms Ranges (RAU 2A)

Camp Bonneville Military Reservation

23201 Northeast Pluss Road,
Vancouver, WA 98682

Prepared For:
Washington State
Department of Ecology

Prepared By:
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BCRRT

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LIST OF ACRONYMS AND ABBREVIATIONS

Army	Department of the Army
bgs	below ground surface
BCT	BRAC Cleanup Team
BRAC	BRAC Base Realignment and Closure
ca	carcinogen
CFR	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLAP	contract laboratory program
COPC	chemical of potential concern
CRREL	U.S. Army Cold Regions Research and Engineering Laboratory
CSM	Conceptual Site Model
DQO	data quality objective
Ecology	Washington State Department of Ecology
EDF	electronic data format
EO	exploded ordnance
EPA	U.S. Environmental Protection Agency
FBI	Federal Bureau of Investigation
FSP	Field Sampling Plan
GIS	geographic information system
HASP	health and safety plan
HSO	health and safety officer
HE	high explosive
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID	investigation-derived waste
ITR	Independent Technical Review
µg/L	micrograms per liter
MDL	method detection limit
MRL	method reporting limit
MTCA	Model Toxics Control Act
NC	nitrocellulose
NC	noncarcinogen
NG	nitroglycerine
NGVD	National Geodetic Vertical Datum
NQ	nitroguanadine
OB	open burning
OD	open detonation
PA	picric acid
PCBs	polychlorinated biphenyls
PE	performance evaluation
PETN	pentaerythitol tetranitrate
Pt	Troutdale formation
PVC	polyvinyl chloride
Qa	quaternary flood plain
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
Qls	quaternary landslide deposit

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
SAP	sampling and analysis plan
SASR	Supplemental Archive Search Report
SI	Site Investigation
SOW	Statement of Work
SVOC	semivolatile organic compound
TBD	To Be Determined
TCRA	Time Critical Removal Action
TNT	2,4,6-trinitrotoluene
TPH	total petroleum hydrocarbons
Tv	volcanic bedrock
USACE	U.S. Army Corps of Engineers
USCS	Unified Soil Classification System
UST	underground storage tank
URS	URS Greiner Woodward Clyde
UXO	unexploded ordnance
VOC	volatile organic compound
WAC	Washington Administrative Code

1.0 INTRODUCTION

This document presents the results of a remedial investigation/feasibility study (RI/FS) of the Small Arms Ranges at the Camp Bonneville Military Reservation (Camp Bonneville). The Small Arms Ranges remedial investigation (RI) included the soil investigation of 17 Small Arms Ranges. The RI was conducted to characterize soils at these areas at Camp Bonneville in order to provide data upon which to base decisions for further actions. Based on the results of the RI, the feasibility study (FS) was conducted to identify and evaluate cleanup action alternatives and select a cleanup action for the Small Arms Ranges. This RI/FS was conducted by the Department of the Army (Army) in accordance with the requirements of the Washington Model Toxics Control Act (MTCA) regulations, which are contained in Chapter 173-340 of the Washington Administrative Code (WAC 173-340).

The original formation of this document was completed under a Department of the Army Fort Lewis, Washington GSA Contract Number GS-10F-0028J for the Washington Department of Ecology (WDOE) in March 2005. The original preparers were Calibre. The document has been modified slightly in order to reflect the changes in the ownership of the Camp Bonneville property and in the identities of the consultants and contractors conducting the work under this new ownership.

1.1 Site Background

Camp Bonneville is located in southwestern Washington and comprises approximately 3,840 acres (see **Figure 1**). Camp Bonneville is located approximately five miles east of the Vancouver City Limits in Clark County. The Army used Camp Bonneville for live fire of small arms, assault weapons, artillery, and field and air defense artillery between 1910 and 1995. In the early 1950s, the Defense Department arranged to lease an additional 840 acres from the State of Washington to expand training possibilities off the post. The facility has been used for weekend and summer training by the U.S. Army Reserve units in Southern Washington and Northern Oregon and is currently a sub-installation of Fort Lewis. Other Reserve and National Guard components, as well as the Federal Bureau of Investigation (FBI) and local law enforcement units, have also used the site.

Camp Bonneville is more particularly described in U.S. Public Land Survey terminology as follows:

- The site is located in Range 3 East relative to the Willamette Primary Meridian. It includes the following parcels in Township 2 North:
    - Section 1 – all (640± acres) – owned
    - Section 2 – all (640± acres) – owned
    - Section 3 – all excepting two parcels along the western boundary of Section 3 (618± acres) – owned;
    - Section 10 – North ½ (320± acres) – owned
    - Section 11 – Northwest ¼ except the southeast triangular ½ of southeast ¼ of this ¼ and the northwest ¼ of northeast ¼ (200± acres) – leased from Washington State Department of Natural Resources

- The following parcels are located in Township 3 North:
  - Section 34 – Southeast ¼ (160± acres) – owned
  - Section 35 – all (640± acres) – owned
  - Section 36 – all (640± acres) – leased from Washington State Department of Natural Resources

In July of 1995, Camp Bonneville was selected for closure under the 1995 Base Realignment and Closure (BRAC) process. Since the camp was officially closed, investigations were conducted by the Army and its consultants in order to characterize the nature and extent of contamination at the site and to develop a plan for potentially transferring ownership. Clark County (County) expressed interest in the site and began the process for obtaining the property by developing a Reuse Plan. The reuse plan developed called for the majority of Camp Bonneville to be transferred to Clark County (County) for the public benefit – education, law enforcement, and parks, with no financial gain to the county.

In October 2006 the Army transferred ownership of the property to the County which subsequently and immediately transferred ownership to the Bonneville Conservation Restoration and Renewal Team, LLC (BCRRT). BCRRT will hold the deed of the property during investigation and clean-up activities at the site. After the property is cleaned to WWDOE standards, BCCRT will transfer the property back to the County. The County will then begin implementing the reuse plan.

This RI/FS report describes the findings of completion of a remedial investigation and feasibility study conducted on the Small Arms Ranges.

The Small Arms Ranges RI consisted of investigating two areas at the firing ranges as follows:

- Seventeen (17) areas that were used as small arms firing ranges, and

- Twelve (12) muzzle blast zones of firing ranges where the firing lines were known.

For administrative reasons, the Camp Bonneville site is divided into three Remedial Action Units. The Remedial Action Units established at Camp Bonneville include the following:

- Remedial Action Unit 1: The unit consists of 20 acres where hazardous substances (other than ammunitions) have been found.

- Remedial Action Unit 2: The unit is divided into three subunits, as follows:

  - Remedial Action Unit 2A consists of the small arms range areas.
  - Remedial Action Unit 2C consists of two demolition areas know as Demolition Area s 2 and 3.
  - Remedial Action Unit 2C is the site of a former combined landfill and demolition area know as Landfill 4 / Demolition Area 1.

- Remedial Action Unit 3: The area includes the entire site where ammunition residuals (including unexploded ordnance) may be found.

In addition to the investigation findings and cleanup actions proposed in this document, the Army is investigating and determining cleanup needs at other areas within Camp Bonneville that include other areas within Remedial Action Unit 2 and the other Remedial Action Units.

1.2 Objectives of the RI/FS

The following describes the objectives of the RI and the FS for the Small Arms Ranges.

The objectives of the RI were to:

- Provide data needed to determine whether actions are required because of soil contamination at the Small Arms Ranges; and

- If actions are required, to provide data needed to select these actions.

The objectives of the FS were to:

- Identify cleanup action alternatives that will meet cleanup action objectives for Small Arms Ranges; and

- To provide information needed to select preferred cleanup action alternatives for Small Arms Ranges that satisfy the requirements of WAC 173-340-360.

The Army implemented RI activities at the Small Arms Ranges in 2002 and 2003. The specific actions conducted to obtain the data required to meet the RI objectives and the results of the investigations are presented in **Section 3.0**, Field Investigations. The general investigative approach at each of the 17 Small Arms Ranges investigated was designed to collect the following data:

- The concentration of lead residues in the top 0-6 inches of soil at 307 sample areas (one-half acre grids) within firing ranges.
- The background concentrations of lead in 20 samples from the top 0-6 inches of soil at undisturbed/unused locations within Camp Bonneville.
- The concentrations of explosive residues in soil in 12 muzzle blast areas of the firing ranges where the firing location is known.

The specific sampling and analysis protocol used to collect the RI data at each of the 17 ranges, and the muzzle blast zones at 12 of these ranges, along with the number of samples collected, sample location, and analyses are presented in **Section 3.0**.

1.3 General Site Information

This section contains the following general facility information required by WAC 173-340-

350(7)(c)(i):

Project title: Remedial Investigation and Feasibility Study Report for Small Arms Ranges:

Project coordinators: Name: Michael Gage
Address: Bonneville Conservation Restoration and Renewal Team, LLC
23201 Northeast Pluss Road
Vancouver, WA 98682

Phone number: (360)566-6990

Facility location: The Small Arms Ranges investigated are within the boundaries of Camp Bonneville that is located in southwestern Washington, approximately 5 miles east of the Vancouver City limits in Clark County (see **Figure 1**). Locations of the 17 Small Arms Ranges investigated are presented in **Figure 2**. Figures of each of the 17 Small Arms Ranges investigated are presented within this report. Camp Bonneville is located in Sections 34 and 35, Township 3 North, Range 3 East and Sections 1, 2, 3, and 10 Township 2 North, Range 3 East.

Dimensions of facility: Camp Bonneville encompasses approximately 3,840 acres. The numerous areas investigated during the RI, range in size from less than an acre to several acres in size. The dimensions of the area investigated at each of the specific areas are presented in the description of the sampling conducted in **Section 3.0**.

Present owner and operator: Camp Bonneville and the Small Arms Ranges investigated are owned and operated by the Bonneville Conservation Restoration and Renewal Team, LLC.

Chronological listing of past owners and operators and operational history: The Department of the Army owned and operated the Camp Bonneville site since the early 1900's through October 2006. In October 2006 the Army transferred ownership of the property to the County which subsequently transferred the land to the BCRRT. Camp Bonneville was used by the Army as firing range for small arms, artillery, and other munitions from the approximately 1910 through 1995. The BCRRT will hold the deed of the property during investigation and clean-up activities at the site. After the property is cleaned to Washington Department of Ecology (WDOE) standards the BCCRT will transfer the property back to the County

1.4 Report Organization

This section of the RI/FS report presented introductory information, including background on the activities leading up to this RI/FS, the purpose of the RI/FS, and general site information required by WAC 173-340-350(7)(c)(i). **Section 2.0** presents information on site conditions required under WAC 173-340-350(7)(c)(iii). This information includes that developed during this RI, as well as information developed during previous investigations at Camp Bonneville. Field activities that were conducted during this RI are described in **Section 3.0**. **Section 4.0** discusses the evaluation of human health and ecological risks. **Section 5.0** presents conclusions with respect to on-site contamination and the need for cleanup actions, and presents remedial objectives. **Section 6.0** then identifies general response actions based on these conclusions and objectives. Specific cleanup technologies applicable to the site are identified in **Section 7.0**. **Section 8.0** identifies cleanup action alternatives, evaluates these alternatives with respect to the requirements contained in WAC 173-340-360, and identifies the preferred cleanup actions for Small Arms Ranges. References are presented in **Section 9.0**.

2.0 SITE CONDITIONS

This section presents descriptions of site conditions relevant to the RI/FS. **Section 2.1** presents the general facility conditions identified in WAC 173-340-350(7)(c). **Sections 2.2** through **2.7** address the specific characteristics identified in WAC 173-340-350(7)(c)(ii) through (iii), respectively. Many of these conditions have been characterized by previous investigations at Camp Bonneville. As appropriate, the results of investigations at the sites are summarized in this section. Where required information was not available from previous investigations, additional data were obtained from RI activities, including the field investigations described in **Section 3.0**.

2.1 General Site Conditions

This section presents a summary of site conditions, including a site conditions map as required by WAC 173-340-350(7)(ii).

Camp Bonneville comprises approximately 3,840 acres and is located in southwestern Washington approximately 5 miles east of the Vancouver City limits in Clark County. Camp Bonneville was officially closed in 1995 and is currently owned by the BCRRT. The Army used Camp Bonneville for live fire of small arms, assault weapons, artillery, and field and air defense artillery between 1909 and 1995. A portion of the property (840 acres) is leased from the State of Washington. The facility has been used for weekend and summer training by the U.S. Army Reserve units in Southern Washington and Northern Oregon, other Reserve and National Guard components, FBI, and local law enforcement units. Camp Bonneville was included on the 1995 Base Realignment and Closure (BRAC) list.

Camp Bonneville is mostly undeveloped forested hillsides and creek side drainages. Former military barracks and training facilities are concentrated at Camp Killpack and Camp Bonneville cantonment areas, which cover approximately 30 acres. Other developed areas include firing ranges, a paved two-lane road connecting the main gate with the two containment areas, and a network of unpaved roads. The main gate to Camp Bonneville is located on the western boundary of the camp, approximately one mile north of Pluss Road.

Camp Bonneville site condition maps are shown on **Figures 2** and **3**. The known site conditions of the Small Arms Ranges investigated during the RI and the general sampling strategy are as follows:

Small Arms Ranges

The Small Arms Ranges have been used as firing ranges for a variety of weapons training. Approximately 25 potential ranges have been identified from maps dating back to 1958. The firing ranges were used for small arms, large-caliber machine guns, rifles, grenades, light anti-tank weapon rockets, and subcaliber weapons. Seventeen firing ranges were identified for investigation during the RI. Of the original 25 potential ranges, some had historically different names and were determined to be at the same location and double counted.

The RI at the Small Arms Ranges was designed to evaluate the potential for soil contamination.

The Small Arms Ranges site condition maps are shown on **Figures 2** and **3**. The soils at 17 Small Arms Ranges were sampled to identify/evaluate the presence of lead and/or explosives residues in shallow soil. Previous investigations at other ranges have detected lead and other metals in range soils (ITIR 2003). Soil samples were collected from half-acre grids across all the 17 Small Arms Ranges (307 half-acre grids were sampled). All range samples were analyzed for lead. Samples collected in the muzzle blast zones were analyzed for explosives. Areas excluded from this soil-sampling program are target areas/impact zones, and firing lines. These excluded areas will be covered separately by investigations and/or removal actions.

Background soil samples were collected as part of the Small Arms Ranges investigation. Soil samples from suitable background areas within Lacamas Valley were collected and analyzed for lead using EPA Method 6010. Twenty (20) background soil samples were collected and analyzed.

2.2 Geology and Hydrogeology

A detailed summary of existing information on the geology and hydrogeology of the Camp Bonneville area has been prepared in prior investigation reports. The following sections provide excerpts of the information previously prepared (URS 2001) and information collected during conduct of the RI at Camp Bonneville.

2.2.1 Regional Geology and Physiography

Camp Bonneville is situated on the margin of the western foothills of the southern Cascades in the transition zone between the Puget Trough and the Willamette Trough Provinces. The geology of this area generally consists of Eocene and Miocene volcanic and sedimentary rock types overlain by unconsolidated clays, silts, sands, and gravels of the Troutdale Formation (Phillips 1987).

The area surrounding Camp Bonneville is sparsely populated with scattered residences and is used primarily for agriculture and livestock grazing. The nearest town is Proebstel, an unincorporated community about 2.5 miles to the southwest of the western entrance to the camp. The two cantonments, Camp Killpack and Camp Bonneville, are located on the valley floor. The remainder of Camp Bonneville consists of moderately steep, heavily vegetated slopes that have been used primarily as firing ranges. The valley floor is a relatively narrow floodplain, which ranges from an elevation of about 290 feet National Geodetic Vertical Datum (NGVD) on the western end of Camp Bonneville to about 360 feet NGVD on the east. The adjoining slopes rise moderately steeply to elevations between approximately 1,000 and 1,500 feet NGVD along ridge tops within the property boundaries. The entire installation is heavily vegetated.

2.2.2 Surface Water and Sediments

The principal surface water feature in the vicinity of the investigation area is Lacamas Creek, which flows southward from the confluence of two branch streams in the north-central part of Camp Bonneville, exiting the installation at its southwest corner.

From the southwestern property boundary, Lacamas Creek flows southwestward to Proebstel, where it turns toward the southeast and continues to its confluence with the Columbia River at the town of Camas. Numerous minor tributaries, that drain adjacent uplands, flow into Lacamas Creek. Buck Creek and David Creek, the largest of these streams, drain the southeastern hills of Camp Bonneville.

Two artificial impoundments of Lacamas Creek, with a total surface area of less than 4,600 square feet, have been created to support a trout sports fishery. Recently, the impoundments have been drained. Sediments of concern at Camp Bonneville only include the sediments within the Popup Pond that are being investigated separately from this RI.

2.2.3 Geology and Soils

Camp Bonneville is situated along the structural and physiographic boundary between the western flank of the southern Cascade Mountains and the Portland-Vancouver Basin. The geology of the Camp Bonneville vicinity is known primarily from geologic mapping by Mundorff (1964) and Phillips (1987), a limited number of well logs available from the general area, and a Multi-Sites Investigation conducted by Shannon & Wilson (1999a).

The geology at Camp Bonneville can be divided into three general areas that correspond approximately to topographic divisions. The area west of Lacamas Creek is composed of a series of predominantly gravel and semi-consolidated conglomerate layers with scattered lenses and stringers of sand (Upper Troutdale Formation).

Underlying the Troutdale Formation and comprising the area to the north and east of Lacamas Creek are predominantly basalt flows and flow breccia, with some pyroclastic and andesitic rocks that are folded and faulted. The bottomland along Lacamas Creek is composed of unconsolidated silt, sand, and gravel valley fill, with some clay. Because of the thick soil and dense vegetation, faults have not been identified within Camp Bonneville (Environmental Science and Engineering, Inc. [ESE] 1983).

The Camp Bonneville soils are mainly low-permeability clays, which results in considerable runoff after storms and occasional minor flooding of Lacamas Creek. Upland soils have mainly developed from basalt and are generally gravelly or stony and fairly shallow. Bottomland soils along Lacamas Creek tend to be clayey (Geo Recon International 1981). Shannon & Wilson (1999a) described the four distinctive stratigraphic units that underlie Camp Bonneville:

- Quaternary floodplain and stream channel alluvium and lacustrine deposits, which mantle the Lacamas Creek valley floor (Qa).
- A Quaternary landslide deposit (Qls) of surface soils and bedrock displaced from the steep slope along David Creek.
- A thick sequence of Quaternary to Pliocene-age gravel, fine-grained sand, and sand with cobbles and boulders known as the Troutdale Formation (Pt), which underlies areas to the west of the Bonneville cantonment.

- Oligocene volcanic bedrock (Tv), which is exposed at the surface in the eastern part of Camp Bonneville.

Quaternary alluvium deposits comprise the shallow surface soils of the Lacamas Creek valley floor, which is composed of stream channel, floodplain, and alluvial fan sediments. These deposits are expected to consist of a thin layer of clay and silt, underlain by layers of sand/silt and clay. During drilling and excavation activities associated with the removal of an underground storage tank (UST) in Camp Killpack (Hart Crowser 1996), at least 25 feet of silty clay was encountered and interpreted to be older alluvium. Borings from the Multi-Sites Investigation (Shannon & Wilson 1999a) also encountered alluvial clays and silts overlying a relatively thick, silty clay deposit in the Camp Bonneville cantonment. These clayey soils probably originated as water borne sediments that were deposited on the valley floor in Quaternary time as a result of catastrophic flooding along the Columbia River (Shannon & Wilson 1999a).

The Troutdale Formation, which underlies the western-most portion of the camp, ranges from poorly consolidated sand and gravel to a well indurated conglomerate in its upper part. Based on regional boring logs, the Upper Troutdale Formation locally is about 150 feet thick and consists of cemented sand, gravel, sandy clay, and boulders. It is underlain by up to 150 feet of the Lower Troutdale Formation, which contains considerably more clay interspersed with sandy and gravelly layers. There is considerable variation in the lithology and thickness of the Troutdale Formation. In general, the formation thins eastward against the underlying bedrock, and the lower part of the formation reportedly is typically coarser grained toward the east (Mundorff 1964).

The bedrock that underlies the alluvial deposits and Troutdale Formation is exposed at the surface in the eastern part of Camp Bonneville. This bedrock consists of Oligocene-age andesite and basaltic andesite flows, minor flow breccias, tuffs, and volcaniclastic sandstones. According to the logs of borings from the Multi-Sites Investigation (Shannon & Wilson 1999a), the uppermost bedrock is severely weathered. This weathered bedrock tends to form surface soils that contain gravel of basalt lithology. During drilling for the Multi-Sites Investigation, bedrock was encountered in 10 soil borings at depths ranging from approximately 6 to 37 feet below ground surface (bgs).

2.2.4 Regional Hydrogeology

Limited information is available about the hydrogeology of Camp Bonneville. Most prior work throughout the Clark County area has focused on the Troutdale Formation (as described in Mundorff 1964). Camp Bonneville resides over the eastern edge of the Troutdale Formation where it is pinched out by the underlying bedrock. There are two drinking water wells at Camp Bonneville: a 385-foot-deep well at the Camp Bonneville cantonment, and a 193-foot-deep well at the Camp Killpack cantonment (ESE 1983). The latter well is apparently different from the 516-foot-deep well at the Camp Killpack cantonment described by Mundorff (1964). In addition, a well was drilled at the Federal Bureau of Investigation (FBI) range during 1998, which extends to a depth of 105 feet bgs (Shannon & Wilson 1999b). Several groundwater monitoring wells associated with the sewage lagoons are located east of the Camp Bonneville cantonment. Based on regional information from Mundorff (1964) and the reported depths of the wells at the camp, water supply wells in the area generally extend into the Troutdale Formation or underlying bedrock. Most of the nearby wells apparently obtain groundwater from depths of 150 to as much as 500 feet bgs.

The water table is typically within a few feet of the surface in areas underlain by alluvium and appears to fluctuate seasonally by several feet. A rising water table occurs in the early fall through spring during the rainy season, and a declining water table occurs throughout the summer. The localized groundwater flow generally follows local topography toward tributaries and creeks.

Generally, groundwater flows from the uplands towards Lacamas Creek. The elevation of the water table in the alluvial valley areas of Camp Bonneville is expected to be fairly shallow (in the range of 5-20 feet bgs) based on the presence of shallow bedrock, multiple creeks, tributaries, and boggy areas.

Two monitoring wells were installed as part of the investigation of Landfill 4, an upland area of Camp Bonneville (Shannon & Wilson 1999b). The depths to water in the wells ranged from 10.4 feet bgs to 18.8 feet bgs. The limited groundwater elevation data suggested a groundwater flow direction towards the creek, which is consistent with the surface topography.

Previous upgradient investigations (Landfill 4) detected explosives and volatile organic compounds in groundwater samples collected from specific wells. Other upgradient land uses that could have contributed chemicals of potential concern (COPCs) include firing ranges, open burning and open detonation grounds, and one or more underground storage tanks that have been removed.

Specific geologic and hydrogeologic data obtained during recent groundwater investigations at Camp Bonneville are presented in the following sections.

2.2.4.1 Groundwater Flow

Groundwater within the shallow alluvium and Upper Troutdale Formation flows horizontally toward Lacamas Creek from upland areas within the Lacamas Creek valley, which encompasses most of Camp Bonneville. The general groundwater flow is to the southwest through the Lacamas Creek Valley and groundwater leaves Camp Bonneville where Lacamas Creek exits the western boundary of the camp. A small area north of the Lacamas watershed appears to drain west into another watershed.

Based on monitoring wells recently installed in the area where Lacamas Creek intercepts the western boundary, and upgradient wells installed at Demolition Areas 2 and 3, the following observations were made:

- A mild downward vertical gradient occurs in wells located along the western boundary where the Upper Troutdale Formation is exposed at the surface and is unconfined.

- Where the Upper Troutdale in confined by overlying alluvium (near Demolition Area 3) an upward gradient (artesian well) was observed.

- Depths to water are approximately 10 feet bgs at the boundary area wells, 12 feet bgs at DA3, and approximately 5 feet bgs at DA2.

- Horizontal groundwater flow within the Upper Troutdale and alluvium typically follows the topographic contours within the Lacamas watershed and exits Camp Bonneville near the Lacamas Creek boundary area.

2.2.4.2 Groundwater Quality

Previous investigations at Landfill 4 detected explosive residues (RDX and HMX), and volatile organic compounds (VOCs) in groundwater samples collected from specific wells. Eight monitoring wells recently installed and sampled (January 2003) near where Lacamas Creek exits the Camp Bonneville boundary, showed no signs of contamination above applicable standards for explosives, metals, VOCs, SVOCs, or TPH compounds. Monitoring wells were also installed near Demolition Area 2 and Demolition Area 3. Monitoring of these wells is currently being conducted and the results of the groundwater investigation are being reported separately.

2.3 Air

Hazardous substances at the Small Arms Ranges are not of concern with respect to impacts to air quality. As shown in the CSM, the contaminants of concern are present in soil. Because of the non-volatile nature of the contaminants in surface and subsurface soils, it is unlikely that contaminants would affect the air at the sites. The Clean Air Act under Section 112(b) 3 (7) excludes elemental lead as a hazardous air pollutant. Disturbance of the soil through wind and/or human disturbance could cause dust and release the fine grain soil particles into the air. Dust and potentially contaminated soil could be transported in the air to different locations. Therefore, during soil disturbing actions at Camp Bonneville, controls should be implemented to reduce the generation of dust.

2.4 Conceptual Site Model

A conceptual site model (CSM) identifying sources of hazardous substances, pathways for contaminant migration, and potential receptors are shown in **Figure 4**. The information used to develop this CSM, and conclusions drawn from this CSM, are presented in the following sections

The CSM is intended as a schematic representation of potential pathways by which receptors (humans or other ecological endpoint species) may be exposed to chemicals at or released from a source. The purposes of the CSM are to provide a framework for problem definition, to identify exposure pathways that may result in adverse effects to human health or other ecological receptors, to aid in identifying data gaps, and, if necessary, to aid in identifying applicable cleanup measures targeted at significant contaminant sources and exposure pathways. The exposure pathways in the conceptual site model are shown in **Figure 4**.

An exposure pathway describes a specific environmental pathway by which chemicals may be transported to human or other ecological receptors. A complete exposure pathway requires each of the following six elements:

- Source of chemicals
- Mechanism of chemical release
- Environmental transport medium
- Exposure point
- Intake route
- Human or other ecological endpoints

If one of these elements is absent, the pathway is incomplete and exposure cannot occur. Incomplete pathways, as well as negligible pathways that would not contribute to overall risk estimates, are not expected to result in adverse effects to human health or the environment.

2.4.1 Potential Release and Transport Mechanisms

The potential sources of COPCs are the lead in bullets and explosive residues near the firing lines. Contaminants emanating from these potential soil sources may migrate from near the soil surface to deeper soils and have the potential to enter groundwater and surface water. In addition, the COPCs can bind to soil and be transported by fugitive dust. The main release mechanisms for COPCs to the environment include:

- Leaching from potentially contaminated soil into deeper soils,
- Infiltration to groundwater, and
- Stormwater runoff and wind releasing soils to down slope/downwind areas.

Elemental lead from bullet slugs and bullet fragments can be transported as a particulate by the action of surface water, groundwater, and wind. Precipitation runoff and wind could distribute lead particulates and lead contaminated soil particles down slope or along the prevailing wind direction.

When lead is exposed to the atmosphere and precipitation, elemental lead will tend to oxidize or corrode over time. Oxidation products consist primarily of lead hydroxide and lead carbonates. As solids, lead and these oxidized compounds are nearly insoluble. Lead compounds show the greatest solubility at very acidic or alkaline conditions.

The potential migration of the COPC at the Small Arms Ranges, lead, is minimized because lead tends to bind strongly to soil particles. Therefore, it is unlikely that lead would migrate through the soils at the ranges and impact groundwater. Stormwater and/or erosion could transport contaminated soil particles to surface water bodies. Investigations of potential groundwater and surface water contamination at Camp Bonneville have been conducted. There is no evidence of lead impacting surface water or groundwater at Camp Bonneville (Hart Crowser 2000 [surface water] and various investigations at Landfill #1, Demolition Area 2 and 3, boundary area wells, and quarterly monitoring [groundwater]). Results of these studies are being reported in separate investigative reports.

2.4.2 Potential Human Receptors

Potential human receptors include current and future on-site workers, future users of the site for recreation and training, and current and future offsite residents downgradient of the firing ranges. Hypothetical future onsite visitors and workers that are assumed to have unrestricted access to soil are included in the CSM. The potential exposure mechanisms to COPCs in soil consist of dermal contact, ingestion, and inhalation of on site soil.

2.4.3 Potential Ecological Receptors

Camp Bonneville is a heavily wooded area with Douglas fir, western red cedar, western hemlock, and red alder as the dominant tree species. Depending primarily on moisture gradients, the understory is composed of salal, Oregon grape, vine maple, and sword fern (Larson 1980 and GeoRecon International 1981). Several species of small mammals and birds reside on the site including cottontail rabbits, ground squirrels, mice, and shrews. Large mammals such as deer, bears, and cougars are also present at Camp Bonneville. There are also several special-status species present at or near Camp Bonneville. Species confirmed at or near Camp Bonneville include:

- Plants
  - Hairy-stemmed checker-mallow (state endangered species)
  - Small-flowered trillium (state sensitive species)

- Amphibians
  - Northern red-legged frog (federal species of concern)

- Birds
  - Vaux’s swift (state candidate species)
  - Pileated woodpecker (state candidate species)

- Mammals
  - Brush Prairie (Northern) pocket gopher (state candidate species)

- Fish
  - Coastal Cutthroat Trout: federal species of concern.

Potential primary receptors on site include terrestrial animals that may be exposed to COPCs in surface and subsurface soils (i.e. burrowing animals). Terrestrial plants and waterfowl could also be exposed to COPCs in soils. Terrestrial animals and plants, benthic invertebrates, aquatic plants, and fish could be exposed to COPCs in surface water and sediments. Potential offsite exposure would involve direct exposure to soil released into the air. The potential exposure mechanisms to COPCs in soil consist of dermal contact, ingestion, inhalation, and uptake (plants).

2.5 Natural Resources and Ecology

It is unlikely that archaeological significant items will be discovered during current or future activities at the Small Arms Ranges. In the unlikely event that human remains or other archaeological significant items are encountered during field activities, work will cease in the area of the find and all materials will be left intact. The Contractor Manager will notify the BCRRT Project Manager within four hours of the find. The BCRRT Project Manager will contact the Clark County Sheriff's Department to ascertain whether the items are of recent origin. Should the Sheriff's Department determine that the items are associated with Native American burial practices, the BCRRT Project Manager will also notify the appropriate Native American tribal contacts for consultation about the nature and disposition of the items discovered.

A number of plant and vertebrate animal species that are either federally or state-listed as endangered or threatened, or are candidates for such listing, have either been documented at Camp Bonneville or are likely to occur there. These species are described in **Section 2.4.3**. Therefore, care will be required to avoid disruption of such species should they be present. If future actions are required at the Small Arms Ranges, field personnel will be directed to minimize disruption to plant and animal species, regardless of their protected status. Upon discovery of potentially sensitive habitats that could be harmed by site activities, measures will be taken to protect plants and animals from harm.

2.6 Hazardous Substance Sources

As shown in the CSM, the source of the soil contaminants present at the Small Arms Ranges is the historical release of contaminants to soil. Contaminants such as lead and explosive residues released at the sites through firing range activities and the sources of these contaminants are discussed below.

Lead

Variable concentrations of lead are known to exist at Camp Bonneville within the surface and near-surface soils at firing ranges. The source of this lead is bullets from the firing of small arms, assault weapons, artillery, and field and air defense artillery. Most of the lead bullet mass deposited in the impact area is in the form of intact bullets or large fragments; however small fragments are also present. The majority of lead bullets are likely to have impacted range berms; however, lead could be present between the firing line and the range berms. Over time elemental lead will corrode and form oxidized products consisting primarily of lead hydroxide and lead carbonates

(ITRC 2003). Due to the low mobility of lead in soil, the majority of the lead contamination is expected to have remained near the surface of the soil. The major risk posed by any metal residues arises from direct contact and ingestion of surface soil.

Explosives

The concentrations of explosive residues in the soil are expected to vary extensively throughout the Small Arms Ranges, but are most likely to be found (if detectable) in the muzzle blast area. Explosives are used as the propellant for shooting munitions forward. Propellants consist primarily of nitroglycerine and nitrocellulose. The source of the explosives is residue from barrel emissions during live fire of small arms, assault weapons, artillery, and field and air defense artillery. Explosives have a greater mobility in soils than lead.

2.7 Regulatory Classifications

Camp Bonneville and the Small Arms Ranges are located in air quality maintenance areas for ozone and carbon monoxide. As described in **Section 2.3**, hazardous substances present at the site are not volatile and generally not being released to the atmosphere, and there are currently no regulatory issues related to air quality. It is possible that future activities at the site could involve remedial actions that have the potential to emit hazardous substances to the air (e.g., dust from soil removal activities). Such activities would be regulated by the Clean Air Act and may require a permit.

The creeks and tributaries at Camp Bonneville are classed as Class A water bodies under WAC 173-201A-120 (6). These include Lacamas Creek, Buck Creek, David Creek, and tributary streams. Water quality of this class is designated as “excellent” and shall meet or exceed the requirements for all or substantially all uses. Class A water bodies must support a variety of uses, including fish and shellfish migration, rearing, spawning, and harvesting; recreation; and commerce and navigation. Cleanup standards developed for the Small Arms Ranges would be based on protecting water quality and supporting these uses.

Groundwater at the site is used to provide service to the two cantonment areas. There are two well sites, two reservoirs, and two independent water systems serving Camp Killpack and Camp Bonneville cantonment. The water quality from both of these systems is regulated under the local health department requirements. Groundwater investigations have been conducted at Camp Bonneville and are results of these investigations are being reported in other investigative reports.

3.0 STUDY AREA INVESTIGATIONS

This section describes the specific field activities undertaken during RI activities, and presents the results of the investigations at the Small Arms Ranges. The RI activities described below include the soil sampling conducted at the Small Arms Ranges in **Section 3.1**. **Section 3.2** describes the analyses and analytical methods for soil samples collected during the RI. The analytical results are presented in **Section 3.3** and a summary of the nature and extent of contamination is presented in **Section 3.4**.

Sampling was conducted by Atlanta Environmental Management, Inc. (AEM) during February and March 2003. Sampling and analyses were conducted in accordance with the approved Sampling and Analysis Plan and Quality Assurance Project Plan (AEM 2003a). Site activities were conducted in accordance with the Site Safety and Health Plan (AEM 2003a). There were minor sample location adjustments due to natural barriers such as streams, standing water, and boulders as described in **Appendix A**. Following is a summary of the RI sampling conducted. A detailed description of the RI sampling locations, methods, and procedures is presented in the Site Investigation Report (AEM 2003b) located in **Appendix A**.

3.1 Investigation at Small Arms Ranges

The RI at the Small Arms Ranges was designed to evaluate the potential for soil contamination from the firing lines of the ranges to the berms and/or potential impact areas. Previous investigations at other ranges have detected lead and explosives in the range soils. The soils at 17 Small Arms Ranges (see **Figures 5** through **21**) were sampled to identify and evaluate the presence of COPCs. The following section describes the sampling conducted at the 17 firing ranges (**Section 3.1.1**), the muzzle blast zones (**Section 3.1.2**), and the background soil sampling (**Section 3.1.3**).

3.1.1 Sampling of Firing Ranges

Soil samples were collected from half-acre grids across all the Small Arms Ranges (307 half-acre plots were sampled). All range samples were analyzed for lead. Areas excluded from this soil sampling program were range berms and backstops where bullets have accumulated. These excluded areas are being addressed separately by investigations and/or removal actions.

Characterization of each of the 307 half-acre grid in the firing ranges consisted of five grab soil samples collected from 0 – 6 inches in depth from each grid. The samples were screened to remove all clasts larger than 2 mm. The first sample was collected near the center of the sample grid. The remaining four grab samples were each collected at 40 feet from the center sample in each of the four compass directions from the center. Some sample grids were not square due to the proposed removal of target berms and backstops. In those cases, the distance to samples from the center of the grid varied.

The mapped locations and latitude/longitude for the center point of each of the half-acre grids within the firing ranges are included in **Appendix A**. The number of half-acre plots sampled, the number of muzzle blast zones sampled, and the QA/QC samples collected at each of the 17 locations are detailed in Table 3-1.

Table 3-1. Number of Samples Collected at Small Arms Ranges

Small Arms Range	Number of Half-Acre Grids Sampled	Number of Samples from each Range	Number of Muzzle Blast Zones Samples	QA/QC Samples (duplicates)	Total Number of Samples
Close Combat Range	24	120	-	11	131
25 Meter M60 Range/Pistol Range	4	20	6	1	27
Sub Machine Gun Range	7	35	-	3	38
TF Range	8	40	2	4	46
Rifle Ranges 1 & 2	32	160	7	14	181
Field Fire Rifle Ranges 1 & 2	22	110	2	10	122
Infiltration Course North	4	20	2	2	24
Field Firing Range & Pistol Range	14	70	6	16	92
Undocumented Pistol Range	1	5	5	0	10
1,000 Foot Range, Machine Gun & Moving Target Range	30	150	-	15	165
Combat Pistol Range	17	85	6	9	100
Machine Gun Range North	33	165	-	16	181
Machine Gun Range South	26	130	-	13	143
M31 Sub-Caliber Ranges 1 & 2	25	125	6	12	143
25 Meter and Machine Gun Range	13	65	10	7	82
Infiltration Course South	7	35	14	4	53
25 M Record Fire Field/Field Firing Range	40	200	2	20	222
Total	**307**	**1,535**	**68**	**157**	**1,760**

Small Arms Ranges investigated are presented in Table 3-1. At the 17 ranges, a total of 1,535 soil samples were collected and analyzed for lead. **Figures 5** through **19** show the grid locations sampled at each of the 17 firing ranges.

3.1.2 Sampling of Muzzle Blast Zones

For ranges where the firing line has been determined, a muzzle blast zone has been designated as a strip in front of and parallel to the firing line. Samples were collected along that strip at approximately 30-foot intervals within 10 feet of the firing line. A point at the end of the firing line was designated and sampled. A line was then run parallel to the firing line from that first sample and subsequent samples taken every 30 feet. The muzzle blast samples were grab samples of soil from 0 – 6 inches in depth. Samples collected in muzzle blast zones were analyzed in the laboratory for explosives (EPA Method 8330 Modified). The mapped locations and latitude/longitude for the sampling points in each of the muzzle blast zone sampling locations are included in **Appendix A**. The muzzle blast zone samples included collection of 68 grab samples over 12 ranges where the firing line was known. The ranges and number of number of muzzle blast zones sampled are presented in **Table 3-1**. Locations of the muzzle blast zone samples are shown on **Figures 5** through **19** for those ranges where the firing line could be determined.

3.1.3 Background Soil Samples

Twenty (20) soil samples were collected to identify the background levels of lead in soil in the upper soil zone. The number of background samples (20) was selected as a reasonable number to provide an estimate of the range and distribution of lead in background soils. The soil samples collected from the 20 background locations were analyzed for lead using EPA Method 6010. Background soil sample locations were selected based on the following criteria:

- Within the boundary of Camp Bonneville;
- Within similar geology/geomorphology as range grid samples;
- Outside and upslope of the known boundaries of Small Arms Ranges;
- Upslope of known firing line areas; and
- Outside of known demolition, artillery firing points, and artillery impact areas.

Locations of the 20 background samples are shown on **Figure 20**.

3.2 Sample Analyses

Soil samples collected from all Small Arms Range grid locations were analyzed for lead. Results of the lead analyses are reported on a dry-weight basis. At 10 Small Arms Range grid locations, 10 samples were randomly selected from the range soils and analyzed for 9 Priority Pollutant Metals.

Samples collected from the Muzzle Blast Zones were analyzed for explosive residues, including picric acid and pentaerythritol tetranitrate (PETN).

Background soil samples were analyzed for lead and two randomly selected background samples were also analyzed for Priority Pollutant Metals.

The analyses conducted on soil samples collected during the RI, along with the analytical methods, are summarized in **Table 3-2**. Quality Assurance and Quality Control for all analyses are described in **Section 4.0** of **Appendix A**.

Table 3-2 Summary of Sample Analyses

Investigation Area and Sample Types and (Number of Samples)	Laboratory Analysis	Analytical Method (SW 846 or EPA approved)
FIRING RANGES		
Grid Soil Samples (1535)	Lead	EPA Method 7420 (dry-weight basis)
Grid Soil Samples (10)	Metals[a]	EPA Method 6010B
MUZZLE BLAST ZONES		
Soil Samples (68)	Explosives[b] (with Pitric acid and PETN[c])	EPA Method 8330 Modified
BACKGROUND		
Background Soil (20)	Lead	EPA Method 7420 (dry-weight basis)
Background Soil (2)	Metals	EPA Method 6010B

Notes:
[a] Metal analyses included Priority Pollutant Metals: antimony, arsenic, barium, cadmium, chromium, copper, lead, nickel, and zinc.
[b] Explosives included: HMX, RDX, 1,3,5-TNB, 1,3-DNB, Tetryl, NB, 2,4,6-TNT, 4-Am- DNT, 2-Am-DNT, 2,4-DNT, 2,6-DNT, 2-NT, 3-NT, 4-NT, Picric Acid, and PETN.
[c] PETN = pentaerythritol tetranitrate

3.3 Analytical Results

The laboratory analytical results for analyses conducted on samples collected during the RI are presented in this section. The results are summarized for each of the 17 firing range areas, the 12 muzzle blast zones, and the background samples. The following summary of analytical results presents sample results that exceed screening levels, that is, 50 mg/kg lead in soils and explosive residues that exceed the EPA Region 9 Preliminary Remediation Goals (PRGs). Complete analytical results, including all sample results below screening levels and all sample and grid locations, are presented in **Appendix A**. Quality Assurance and Quality Control for all analyses are described in **Section 4.0** of **Appendix A**.

3.3.1 Small Arms Ranges

Tables A-1 through **A-17** (**Appendix A**) present the lead results for all samples collected at the Small Arms Range grid locations. A total of 1,535 samples, not including duplicate samples, were collected and analyzed for lead from 307 grids sampled. Five individual grab samples were collected from each grid.

The number of samples collected at each firing range and the number of samples with lead concentrations exceeding lead screening levels are summarized in **Table 3-3**. The lead concentrations are compared to ecological indicator concentrations and MTCA Method A cleanup levels. These concentrations are used for comparison only and are not intended to be the final cleanup levels or goals for the affected range areas. The concentrations are defined as follows:

- 50 mg/kg - From MTCA Table 749-3, Ecological Soil Concentrations (mg/kg) for Protection of Terrestrial Plants and Animals, for protection of plants. Not a cleanup level
- 118 mg/kg - From MTCA Table 749-3, Ecological Soil Concentrations (mg/kg) for Protection of Terrestrial Plants and Animals, for protection of wildlife. Not a cleanup level.
- 250 mg/kg - From MTCA Table 740-1, Method A Soil Cleanup Levels for Unrestricted Land Uses. Lead cleanup level based on preventing unacceptable blood lead levels.
- 500 mg/kg – Maximum lead concentration allowed for sites cleaned up to Unrestricted Land Use standards.
- 1,000 mg/kg - From MTCA Table 745-1, Method A Soil Cleanup Levels for Industrial Properties. Cleanup level based on direct contact.

Concentrations of lead in Small Arms Range grid samples exceeded the lowest screening level (50 mg/kg) at 14 of the 17 ranges. Approximately 12 percent of the samples collected at the 17 firing ranges had concentrations above 50 mg/kg. The number of samples with lead concentrations exceeding 118 mg/kg was 78, or approximately 5 percent. The percent of samples exceeding 250 mg/kg, 500 mg/kg, and 1,000 mg/kg were approximately 2.5 percent, 1.7 percent, and 1 percent, respectively (**see Table 3-3**).

Ten samples from random range grid locations were also analyzed for metals. The results of these analyses are presented on Appendix A, **Table A-19**. No concentrations of metals were detected in the ten range grid samples at concentrations above MTCA Method A for unrestricted land use, or if no MTCA criteria were available, the EPA Region 9 Preliminary Remediation Goals (PRGs). The reporting limit on several samples was above the MTCA Method A cleanup level for arsenic. In addition, one sample from a muzzle blast zone was inadvertently analyzed by the laboratory for metals. The arsenic concentration in this sample was 22.9 mg/kg, slightly above the Method A cleanup level of 20 mg/kg. All arsenic concentrations were significantly below the natural background levels in Clark County based on EPA Method 6010, Inductively Coupled Plasma (ICP) Atomic Emission Spectroscopy (Ecology 1994).

3.3.2 Muzzle Blast Zones

The 12 ranges where the firing line could be determined were sampled along the muzzle blast zone. The ranges sampled and numbers of muzzle blast zone samples collected are summarized on **Table 3-1**. As presented in **Table 3-2**, samples collected from the Muzzle Blast Zones were analyzed for explosive residues, including picric acid and pentaerythritol tetranitrate (PETN). Results of the analyses are presented in **Appendix A** (**Tables A-23** through **A-34**) for the 12 ranges sampled.

Table 3-3 Number of Samples Exceeding Lead Screening Levels

Small Arms Range	Number of Samples from each Range	Number of Samples > 50 mg/kg	Number of Samples > 118 mg/kg	Number of Samples > 250 mg/kg	Number of Samples > 500 mg/kg	Number of Samples > 1,000 mg/kg
Close Combat Range	120	1	0	0	0	0
25 Meter M60 Range/Pistol Range	20	5	2	0	0	0
Sub Machine Gun Range	35	0	0	0	0	0
TF Range	40	0	0	0	0	0
Rifle Ranges 1 & 2	160	50	18	9	6	5
Field Fire Rifle Ranges 1 & 2	110	14	2	1	1	1
Infiltration Course North	20	0	0	0	0	0
Field Firing Ranges 1 & 2 & Pistol Range	70	10	8	4	2	1
Undocumented Pistol Range	5	2	1	0	0	0
1,000 Foot Range, Machine Gun & Moving Target Range	150	39	24	13	8	6
Combat Pistol Range	85	6	2	1	1	0
Machine Gun Range North	165	11	1	0	0	0
Machine Gun Range South	130	2	2	1	0	0
M31 Sub-Caliber Ranges 1 & 2	125	1	0	0	0	0
25 Meter and Machine Gun Range	65	20	11	7	6	4
Infiltration Course South	35	2	1	0	0	0
25 M Record Fire Field/Field Firing Range	200	16	6	3	2	1
Total	**1,535**	**179**	**78**	**39**	**26**	**18**
Percent of Samples Above Screening Level		**12%**	**5%**	**2.5%**	**1.7%**	**1%**

When compared to the Region 9 PRGs for explosive residues (no MTCA criteria are established), none of the 68 samples from the muzzle blast zones exceeded the screening criteria. The explosive residue 2,4-dinitrotoluene (2,4-DNT) was detected in 8 of 10 muzzle blast zone samples collected from the 25-Meter and Machine Gun Range. Concentrations of 2,4-DNT detected ranged from 4.9 to 20 mg/kg, significantly below the PRG value of 120 mg/kg for residential soil.

Explosive residue concentrations in all other samples collected from the muzzle blast zones were below method reporting limits. Therefore, there were no explosive residues concentrations detected from any of the 12 muzzle blast zones sampled that exceeded any PRG.

One sample from the muzzle blast zones at Rifle Range 1 and 2 was inadvertently analyzed for metals. The only metal detected at a concentration above MTCA Method A for unrestricted land use and/or Region 9 PRGs was arsenic at 22.9 mg/kg. This concentration is slightly above the Method A cleanup level of 20 mg/kg. As discussed in **Section 3.2.1**, this arsenic concentration is within the natural occurring background concentrations in Clark County based on ICP analytical methods.

3.3.3 Background Samples

Twenty background samples were collected and analyzed for lead (see **Table A-18**). Concentrations of lead detected ranged from 9.7 mg/kg to 80.8 mg/kg. The average lead concentration detected was 24.3 mg/kg, or below the most stringent MTCA or PRG value for lead. The 95th percentile upper confidence limit (UCL) on the mean lead background concentration is 33.6 mg/kg.

Two background samples were also analyzed for Priority Pollutant metals. These results are presented in **Appendix A** (**Table A-19**). Metals detected were within normal background ranges.

3.4 Summary of the Nature and Extent of Contamination

This section discusses the nature and extent of soil contamination at the Small Arms Ranges. The contaminants detected above screening levels and MTCA cleanup levels are described along with the location and estimated volume of impacted soil.

3.4.1 Small Arms Ranges

The majority of samples from the Small Arms Ranges with lead concentrations exceeding screening levels were clustered in specific sampling grids. Of the 307 grids sampled, only 75 grids contained samples with lead concentrations above 50 mg/kg. Grids with lead concentrations exceeding 118 mg/kg, 250 mg/kg, 500 mg/kg, and 1,000 mg/kg, were 38, 19, 14, and 10 grids, respectively (**see Table 3-4**).

Of the 307 half-acre grids sampled, only 10 grids, or 3 percent, had lead concentrations exceeding 1,000 mg/kg. The number of grids with samples exceeding 500 mg/kg lead was 14, or approximately 5 percent. Grids with samples exceeding 250 mg/kg totaled 19, or approximately 6 percent of the total grids sampled. A summary of the grid locations and number of grids with lead concentrations exceeding screening values is presented in

Table 3-4. Tables with results from all RI sampling are presented in **Appendix A** of the attached Site Investigation Report. Figures illustrating results from all RI sampling are also presented in **Appendix B** of the Site Investigation Report.

Table 3-4 Number of Grids with Samples Exceeding Screening Levels

Small Arms Range Designation	Number of Grids with Lead Concentrations				
	> 50 mg/kg	> 118 mg/kg	> 250 mg/kg	> 500 mg/kg	> 1,000 mg/kg
Close Combat Range	1	0	0	0	0
25 Meter M60 /Pistol Range	3	1	0	0	0
Sub Machine Gun Range	0	0	0	0	0
TF Range	0	0	0	0	0
Rifle Range 1 & 2	16	8	4	3	2
Field Fire Rifle Ranges 1 & 2	10	2	1	1	1
Infiltration Course North	0	0	0	0	0
Field Firing Range &Pistol	4	3	2	1	1
Undocumented Pistol Range	1	1	0	0	0
1,000 ft Range, 1,000 Machine	11	8	5	3	3
Combat Pistol Range	4	2	1	1	0
Machine Gun Range North	6	1	0	0	0
Machine Gun Range South	2	2	1	0	0
M31 Sub-Caliber Ranges 1 & 2	1	0	0	0	0
25 m & Machine Gun Range	7	6	3	3	2
Infiltration Course South	2	1	0	0	0
25M Record Fire Field Range/Field Fire Range	7	3	2	2	1
Total Number of Grids	**75**	**38**	**19**	**14**	**10**
Percent of Grids with Samples Above Screening Levels	**24%**	**12%**	**6%**	**5%**	**3%**

3.4.1.1 Areas and Volumes at Small Arms Ranges

The areas and volumes of lead contaminated soils at the Small Arms Ranges was calculated based on the locations of the samples containing lead at concentrations exceeding MTCA ecological indicator and cleanup levels. A summary of the areas of ranges affected is presented in **Table 3-5**. Estimated volumes of affected soils are presented in **Table 3-6**.

The areas and volumes of affected soil were calculated based on removing an area 40 by 40 feet by 6 inches deep at any "hot" soil location within a grid. Two 40 by 40 feet areas would be removed if two "hot" soil samples were located in the same grid. If three or more "hot" soils were located within a single grid, the entire grid would be removed.

Table 3-5 Areas of Impacted Grids

Small Arms Range Designation	Area of Impacted Grids (square yards)				
	> 50 mg/kg	>118 mg/kg	> 250 mg/kg	> 500 mg/kg	> 1,000 mg/kg
Close Combat Range	178	0	0	0	0
25 Meter M60 /Pistol Range	2,910	312	0	0	0
Sub Machine Gun Range	0	0	0	0	0
TF Range	0	0	0	0	0
Rifle Range 1 & 2	18,676	10,214	3,144	2,776	2,598
Field Fire Rifle Ranges 1 & 2	2,225	356	180	178	178
Infiltration Course North	0	0	0	0	0
Field Firing Range & Pistol	5,196	2,760	2,604	356	178
Undocumented Pistol Range	312	178	0	0	0
1,000 ft Range, 1,000 Machine	19,850	12,768	7,632	5,196	5,196
Combat Pistol Range	2,954	534	180	178	0
Machine Gun Range North	1,603	178	0	0	0
Machine Gun Range South	356	356	180	0	0
M31 Sub-Caliber Ranges 1 & 2	178	0	0	0	0
25 Meter Machine Gun Range	12,456	5,552	2,784	2,776	445
Infiltration Course South	356	178	0	0	0
25M Record Fire Field Range	7,972	5,018	540	356	178
Total (square yards)	**75,222**	**38,404**	**17,244**	**11,816**	**8,773**

As summarized in **Table 3-5**, the areas of affected soil above MTCA cleanup levels ranges from approximately 9,000 square yards (based on 1,000 mg/kg cleanup level) to approximately 17,000 square yards (based on 250 mg/kg cleanup level). The number of impacted areas varies from 6 to 8 depending on the cleanup levels (250 mg/kg – 1,000 mg/kg).

Table 3-6 Volume of Impacted Grids

Small Arms Range Designation	Volume of Impacted Grids (cubic yards)				
	> 50mg/kg	> 118 mg/kg	> 250 mg/kg	> 500 mg/kg	> 1,000 mg/kg
Close Combat Range	30	0	0	0	0
25 Meter M60 /Pistol Range	486	52	0	0	0
Sub Machine Gun Range	0	0	0	0	0
TF Range	0	0	0	0	0
Rifle Range 1 & 2	3,119	1,706	524	464	434
Field Fire Rifle Ranges 1 & 2	372	59	30	30	30
Infiltration Course North	0	0	0	0	0
Field Firing Ranges 1&2 &Pistol	868	461	434	59	30
Undocumented Pistol Range	52	30	0	0	0
1,000 ft Range, 1,000 Machine	3,315	2,132	1,272	868	868
Combat Pistol Range	493	89	30	30	0
Machine Gun Range North	268	30	0	0	0
Machine Gun Range South	59	59	30	0	0
M31 Sub-Caliber Ranges 1 & 2	30	0	0	0	0
25 m & Machine Gun Range	2,080	927	464	464	74
Infiltration Course South	59	30	0	0	0
25M Record Fire Field Range	1,331	838	90	59	30
Total (cubic yards)	**12,562**	**6,413**	**2,874**	**1,974**	**1,466**

Nine of the 17 Small Arms Ranges do not have any grid sample concentrations that exceed 250 mg/kg lead, the unrestricted land use cleanup level. Only 6 of the 17 ranges exceed the industrial lead cleanup level of 1,000 mg/kg. Therefore, the estimated volumes of affected soil above MTCA cleanup levels range from 2,874 cubic yards (based on 250 mg/kg cleanup level) to 1,466 cubic yards (based on 1,000 mg/kg lead cleanup level).

No other metals were a concern at the 17 Small Arms Ranges based on the 10 range samples analyzed for priority pollutant metals. All metals detected in these samples were detected at concentrations below MTCA Method A unrestricted land use cleanup levels. Therefore, the only contaminant of concern is the lead in soil at the Small Arms Ranges.

3.4.2 Muzzle Blast Zones

There were no concentrations of explosive residues detected in the 68 muzzle blast zone samples at concentrations above the conservative PRG screening levels. The one detection of arsenic in the muzzle blast zone was detected at near the reporting limit and is not considered significant. As discussed in **Section 3.3.2**, there are no contaminants of concern in the muzzle blast zones of the ranges where firing points were identified. Therefore, there are no contaminants of concern within the muzzle blast zones requiring further action.

4.0 RISKS TO HUMAN HEALTH AND ECOLOGICAL RECEPTORS

Selecting a cleanup action requires a determination that each of the requirements specified in WAC 173-340-360 is met, including the requirement that the cleanup action is protective of human health and the environment [(WAC 173-340-357(2)]. Cleaning up a site to MTCA Method A residential land use cleanup standards will provide protection of human health because they provide the most protective cleanup levels. A quantitative human health risk assessment is not required if a site is cleaned up to residential land use standards. The cleanup action proposed for the Small Arms Ranges will meet these criteria, as described in **Section 5.0**. Therefore, the cleanup action proposed for the ranges will be protective of human health if the ranges are cleaned up to residential use standards.

WAC 173-340-7490 specifies the terrestrial ecological evaluation procedures for sites where a release of a hazardous substance has occurred. Because of the prime ecological habitat at Camp Bonneville, the Small Arms Ranges do not qualify for exclusion or a simplified terrestrial ecological evaluation (WAC 173-340-7490). Therefore, a site-specific terrestrial ecological evaluation is required under WAC 173-340-7493.

The first step in conducting a terrestrial ecological evaluation is completing the “problem formulation step”. The first problem formulation step is to determine the chemicals of ecological concern at the affected areas. This evaluation may eliminate hazardous substances from further consideration where the maximum or the upper ninety-five percent confidence limit (UCL) soil concentration found at the site does not exceed ecological indicator concentrations described in MTCA Table 749-3. The table specifies ecological indicator soil concentrations for lead as follows: Plants – 50 mg/kg; Soil Biota – 500 mg/kg, and Wildlife – 118 mg/kg.

MTCA specifies that chemicals of concern used in ecological evaluations may be eliminated from further consideration if “the maximum or the upper ninety-five percent confidence limit soil concentration found at the site does not exceed ecological indicator concentrations described in Table 749-3” [WAC 173-340-7493 (2)(a)(i)]. After the proposed cleanup action described later in this document is conducted, the 17 Small Arms Ranges will have a residual lead concentration of less than 30 mg/kg based on the average 95th percentile UCL of the mean. This UCL is based on grouping the 17 ranges into four data sets for calculating UCLs because the maximum number of data points for “MTCAstat97” is 500. Following remedial action, it is estimated that 2 of the 17 ranges will have range-specific UCLs that exceed the most conservative ecological indicator for plants, 50 mg/kg. The 95th percentile UCL on the mean at one of these ranges, the Undocumented Pistol Range, is skewed high because only five samples were collected at that range. The 25 Meter M60 Range is also skewed high because the data set is comprised of only 20 samples. The other range, the 25 meter and Machine Gun Range, will have a UCL of 54 mg/kg, slightly above the ecological indicator soil concentration for plants of 50 mg/kg.

As stated previously, spent lead bullets will tend to oxidize primarily into the nearly insoluble lead hydroxide and lead carbonate (ITRC 2003). In addition, the phytotoxicity of lead is relatively low compared with other trace elements (Miles 1972). It should also be noted that the MTCA ecological indicator concentrations for plants are based on benchmark values from various studies compiled by Oak Ridge National Laboratory (ORNL) [ORNL 1997]. The vast majority of the lead studies cited used significantly more soluble lead compounds (lead chloride) than the likely form of nearly insoluble lead (lead hydroxide and lead carbonates) at the Camp Bonneville ranges. Therefore, it is very likely that the MTCA ecological indication concentration for plants (50 mg/kg) from lead in soil may not be appropriate for the forms of lead in soils at Camp Bonneville ranges.

A site inspection of the most contaminated grids at the ranges was conducted on June 5, 2003 by Project Performance Corporation. No visual evidence of stressed vegetation was noted. The plant species observed and the health of the plants appeared the same on contaminated and background locations. Therefore, the residual lead concentrations after remediation of the ranges will be insignificant to plants and other ecological receptors and lead in soil will not be considered a chemical of ecological concern.

After reviewing the above “problem formulation step”, no further site-specific terrestrial ecological evaluation is necessary because the cleanup action plan proposed for protection of human health (cleanup to Method A residential land use) will eliminate any significant risks to ecological receptors. In addition, following the proposed cleanup of the lead contaminated areas at the ranges, lead will not be considered a chemical of ecological concern and no further ecological assessment is required under WAC 173-340-7493.

5.0 CLEANUP ACTION OBJECTIVES

This section presents conclusions concerning the need for and objectives of cleanup actions at the Small Arms Ranges. Based on results of RI, the following conclusions are drawn with respect to contamination at the Small Arms Ranges:

- Lead is present in surface and near-surface soil at several Small Arms Ranges at concentrations above cleanup standards.

- Natural attenuation mechanisms do not constitute an effective mechanism to reduce lead contaminant concentrations in soil to cleanup standards.

If cleanup actions were implemented, this would increase the confidence that lead concentrations in soil would be reduced and potentially impacts to deeper soils and possibly groundwater would be reduced. Based on the above conclusions, identification and evaluation of cleanup actions for specific Small Arms Ranges is appropriate.

Cleanup actions at the Small Arms Ranges would have the following objectives:

Prevent the potential exposure of contaminants in soil to human and ecological receptors at concentrations greater than cleanup standards support the proposed re-use and/or redevelopment of the site.

Potential human receptors at the Small Arms Ranges include on-site workers, visitors to the site, and adjacent residents. Potential ecological receptors include plants and wildlife that may use affected areas.

As described previously, soil cleanup standards based on MTCA Method A unrestricted residential use have been determined appropriate for the Small Arms Ranges based on the potential future land use. The ecological indicator concentrations and cleanup levels applicable to soils at the Small Arms Ranges are shown on **Table 5-1**.

MTCA requires the soil cleanup levels be based on estimates of the reasonable maximum exposure expected under both current and future site use conditions. Historically, the site was a US Army military reservation with controlled access and used for short-term, small unit training exercises. Future uses proposed for the site may include development of a regional park and environmental preservation area. The proposed future land uses may include educational activities, law enforcement training, and public recreation. The possible public uses may involve short-term camping and group use of existing or new structures for overnight programs. Based on these potential future land use, the appropriate cleanup level is the MTCA Method A Soil Cleanup Level for Unrestricted Land Use for lead. Therefore, the proposed cleanup level for lead in soil at the Small Arms Ranges is 50 mg/kg. If future land use at Camp Bonneville differs from the proposed land use, the appropriate cleanup level should be reevaluated at that time.

Table 5-1. MTCA Ecological Indicator and Cleanup Levels for Lead in Soil

	Ecological Indicator for Plants[1]	Ecological Indicator for Wildlife[2]	Unrestricted Land Use[3]	Industrial Properties[4]
Lead Concentration (mg/kg)	50	118	250	1,000

Notes:

1 From MTCA Table 749-3, Ecological Soil Concentrations (mg/kg) for Protection of Terrestrial Plants and Animals, a lead concentration of 50 mg/kg is specified for or protection of plants.

2 From MTCA Table 749-3, Ecological Soil Concentrations (mg/kg) for Protection of Terrestrial Plants and Animals, a lead concentration of 118 mg/kg is specified for protection of wildlife.

3 From MTCA Table 740-1, Method A Soil Cleanup Levels for Unrestricted Land Uses. The lead cleanup level is based on preventing unacceptable blood lead levels.

4 From MTCA Table 745-1, Method A Soil Cleanup Levels for Industrial Properties, the cleanup level is based on direct contact.

In developing Method A cleanup levels for unrestricted land use, MTCA [(WAC 173-340-740 (2)] requires that the cleanup level must be as stringent as the following:

- Concentrations in MTCA Table 740-1 and compliance with the corresponding footnotes (this table specifies a lead cleanup level of 250 mg/kg for unrestricted land use);

- Concentrations established under applicable state and federal laws;

- Concentrations that result in no significant adverse effects on the protection and propagation of terrestrial ecological receptors using the procedures specified in WAC 173-340-7490 through 7493 (tables in this section specify ecological indicator soil lead concentrations for plants, soil biota, and wildlife at 50, 500, and 118 mg/kg, respectively).

- Concentrations that are protective of groundwater [Method A cleanup levels were designed to be protective of groundwater, that is, lead concentrations in soil less than 3,000 mg/kg (Ecology 2001).

In addition, MTCA requires the following when determining compliance with cleanup levels:

- The upper one sided 95% confidence limit on the true mean soil concentration shall be less than the soil cleanup level [WAC 173-340-740(7)(d)(i)(a)];

- No single sample concentration shall be greater than two times the soil cleanup level [WAC 173-340-740(7)(e)(i)]; and

- At least 90% of the sample concentrations shall be less than the soil cleanup level [WAC 173-340-740(7)(e)(ii).

Based on these regulations, the approach for cleanup must comply with the following:

- The 95^{th} percentile upper confidence limit (UCL) on the mean lead concentrations remaining after remediation from each small arms range must be less than 50 mg/kg;

- No lead sample concentrations after remediation can exceed 100 mg/kg; and

- At least 90% of the lead concentrations reported in confirmatory samples representing the soils remaining after remediation from each of the Small Arms Ranges must be less than 50 mg/kg.

6.0 IDENTIFICATION OF CLEANUP TECHNOLOGIES

This section identifies specific cleanup technologies that may be used to achieve the cleanup objectives and cleanup levels specified in **Section 5.0**. As noted in WAC 173-340-350(8)(b), in some cases it is necessary to perform an initial screening of alternatives to reduce the number for detailed evaluation. However, for the Small Arms Ranges, appropriate technologies can readily be identified and screening is not necessary. The following technologies have been considered for remediation of the Small Arms Ranges. The discussion for each technology contains a brief description of the technology, its expected effectiveness, and relevant operational concerns

No Action: The no action alternative assesses the consequences of leaving a site in its current state.

Institutional Controls: Institutional controls refer to a broad category of measures that can be used to limit or prevent contact with affected soils. These controls might include deed restrictions, permitting requirements, training programs, and use restrictions. Controls that may be applicable include signs, access restrictions (fences), land use restrictions, and runoff control.

Containment (Capping): Containment for soil refers to a vertical physical barrier (soil cap) intended to reduce infiltration of rainwater through contaminated soil and to restrict direct contact with the soil. Capping would involve placing clean soil cover over the contaminated soil and leaving the contaminated soil in place. An impermeable cap of asphalt, concrete, or geomembrane, also satisfies the basic requirements of physical barriers described above and would further reduce the potential for infiltration of rainwater.

Consolidation and Containment (Capping): Consolidation refers to excavation of contaminated soil above the action level and consolidating the soils into one or more on-site areas. The consolidated soils would then be contained (capped) as described above.

Excavation and Off-site Disposal or Recycling: This alternative refers to excavating soil with contaminant concentrations exceeding a specified action level and hauling the soil to an off-site facility for disposal or recycling. This alternative may also include physical sorting/screening to remove rocks and gravel and possibly larger metal fragments (lead bullets and shells). Soils would have to be tested using TCLP methods to determine if soils are characteristic hazardous wastes under RCRA and would require disposal at one or more RCRA-approved landfills.

7.0 EVALUATION AND SELECTION OF CLEANUP ACTIONS

This section identifies cleanup actions comprised of selected technologies described in Section 7.0, and presents an evaluation of these actions with respect to the selection criteria contained in WAC 173-340-360. This evaluation is designed to provide a basis from which a preferred cleanup action can be selected.

The criteria used for evaluating the alternatives included the requirements established under MTCA (WAC 173-340-360) for evaluation of remedial alternatives. The criteria include four threshold factors: protection of human health and the environment, compliance with cleanup standards, compliance with applicable state and federal laws, and provision for compliance monitoring. The other requirements for the selected alternative are: use permanent solutions to the maximum extent practicable, provide for a reasonable restoration time frame, and consider public concerns.

7.1 Identification of Cleanup Action Alternatives

Based on evaluation of the candidate technologies presented in Section 7.0, five alternative cleanup actions were identified for the Small Arms Ranges. These alternatives consist of the following:

- Alternative 1 - No Action.
- Alternative 2 - Institutional Controls.
- Alternative 3 - Containment (Capping).
- Alternative 4 - Consolidation and Containment (Capping)
- Alternative 5 - Excavation and Off-site Disposal or Recycling

7.2 Procedure for Selection of Cleanup Actions

The MTCA Rules specify the procedure to be used to select the cleanup action from the identified alternatives at WAC 173-340-360. This rule specifies Minimum Requirements for Cleanup Actions at WAC 173-340-360 (2). The Minimum Requirements are further divided into two categories, as follows:

- Threshold requirements (WAC 173-340-360 (2) (a)
    - Protection human health and the environment
    - Compliance with applicable cleanup standards
    - Compliance with applicable state and federal laws
    - Provisions for compliance monitoring

- Other requirements (WAC 173-340-360 (2) (b)
    - Use permanent solutions to the maximum extent practical
    - Provide for a reasonable restoration time frame
    - Consider public concerns

The MTCA Rules also set forth a specific procedure to determine whether a cleanup action uses

permanent solutions to the maximum extent possible. This procedure is found at WAC 173-340-

360 (3) and provides evaluation criteria to determine the permanence of the candidate cleanup action approaches: These seven evaluation criteria are as follows:

- Protectiveness
- Permanence
- Cost
- Effectiveness ver the long term
- Management of short-term risks
- Technical and administrative implementability
- Consideration of public concerns

It is noted that this RI/FS will be subjected to public notice and public comment procedures as specified at WAC 173-340-600. This procedure will provide a mechanism to identify and respond to public concerns that may arise which have not been identified to date for this site.

Also, it is noted that it does not appear necessary or appropriate to apply the Disproportionate Cost Analysis established at WAC 173-340-360 (e) to this RI/FS. The alternatives analysis provided below in this RI/FS does not raise the issue of disproportionate costs. Clearly, however, it is appropriate to conduct a qualitative evaluation of the permanence or the alternate remedial approaches following the procedure defined in the Rules.

The following subsections address these alternative evaluation procedures as follows:

- Section 7.3 provides a description of each alternative and discusses the evaluation of each in terms of the Threshold and Other Requirements with a general discussion of permanence.

- Section 7.4 provides a more detailed qualitative evaluation and ranking of each alternative using the Evaluation Criteria for the Permanence Requirement.

- Section 7.5 provides recommendations and conclusions.

7.3 Detailed Evaluation of Cleanup Action Alternatives

This section presents a detailed evaluation of the five cleanup action alternatives identified in Section 8.1. The following presents s description of each alternative and an evaluation of the alternative with respect to the requirements contained in WAC 173-34-360 (2) and (3).

7.3.1 Alternative 1 – No Action

Description of Alternative: The no action alternative is used to establish the risk levels and site conditions if no physical cleanup actions are implemented. Under the no action alternative, site conditions and risk levels would remain as they currently exist. No

physical changes or land use/access restrictions would be implemented that would affect activities at the site. No engineering or institutional controls would be established and no remedial actions would be initiated to reduce hazard levels at the site. Land development, site maintenance, and site improvements would continue in accordance with prevailing practices.

Threshold Requirements:

Protection of Human Health and the Environment: Under the no action alternative, affected areas of the site would remain as they currently are with no reduction in toxicity, mobility, or volume of impacted soils. No additional protection would be afforded potential human and ecological receptors to reduce the opportunities for ingestion or dermal contact in affected areas. Without institutional controls and physical barriers or capping as safeguards against potential exposure, receptors may inadvertently face exposure to affected soil.

Compliance with Cleanup Standards: The no-action alternative will not meet MTCA cleanup standards because soils with lead concentrations above cleanup standards would remain on site.

Compliance with Applicable Laws: Implementation of this alternative would not involve compliance with laws and regulations related to wastewater discharges, air discharges, or dangerous waste management. Implementation of this alternative would result in compliance with these laws and regulations, but would not satisfy the requirements of MTCA.

Provision of Compliance Monitoring: The no-action alternative would not include compliance monitoring.

Other Requirements:

Permanent Solutions to the Maximum Extent Practicable: This cleanup action would not result in permanent reduction in the toxicity, mobility, or volume of hazardous substance at the site. Therefore, the no action alternative would not provide permanent solutions to the maximum extent practicable.

Attaining Cleanup in a Reasonable Time: The no action alternative does not attain cleanup of the site in a reasonable time. Due to the elemental nature of the contaminant, the no action alternative does not cleanup the site in a reasonable time period.

Public Concerns: Public concerns would be addressed after receipt of public comments on the proposed cleanup action. The no action alternative would not likely address the concerns of the community because no active remediation would be conducted.

7.3.2 Alternative 2 – Institutional Controls

Description of Alternative: The institutional controls alternative refers to establishing access restrictions, legal restrictions, and educational procedures and rules to reduce the potential for adverse impacts. For example, access restriction, such as fences, and education of site visitors would be implemented to limit human access to areas at the site exceeding cleanup levels. The potential exposure pathway would therefore be reduced. As with the no action alternative, this alternative would not treat or additionally contain affected soil and existing potential exposure routes for ecological receptors would remain.

This alternative would include minimum standards for fences and locating signs in affected areas to warn workers and/or visitors on site of the potential for exposure associated with contact with and/or disturbance of the soil. Other posted notices or bulletins would be located in high-visibility areas and periodic reminders would be provided to on-site workers and visitors.

Deed restrictions would be recorded to advise potential owners of the property of the hazards and use limitations associated with the specific affected areas. Grading or excavation in the affected areas would not be allowed without appropriate safety consideration. Zoning and other permit restriction would be implemented to limit site uses to avoid potential exposure. Surface water flow could transport soil in affected areas and control measures would have to be implemented to reduce the potential migration of affected soil. Periodic site inspections would be required to verify the condition of fences and signs and to evaluate the effectiveness of this alternative.

Threshold Requirements: The threshold requirements contained in WAC 173-340-360(2) consist of protection of human health and the environment, compliance with cleanup standards, compliance with applicable laws, and provision for compliance monitoring.

Protection of Human Health and the Environment: Under the institutional control alternative, affected areas of the site would remain as they currently are with no reduction in toxicity, mobility, or volume of impacted soils. Access restrictions and warning signs would reduce the potential opportunities for ingestion or dermal contact by human receptors in affected areas. Fences may limit large mammals from access to the affected areas; however, plants, birds, and small mammals would not be limited from the impacted areas.

Compliance with Cleanup Standards: The alternative will not meet MTCA cleanup standards because lead concentrations in soil above cleanup standards would be left on site.

Compliance with Applicable Laws: Implementation of this alternative would not involve compliance with laws and regulations related to wastewater discharges, air discharges, or dangerous waste management. Deed restrictions and zoning changes would have to be implemented in accordance with local, county, and state laws and regulations. Construction of fences and signs may require a permit and require construction to applicable standards.

Provision of Compliance Monitoring: The institutional controls alternative would include one of the three types of compliance monitoring, that is, conformation monitoring. Access restrictions, such as fences and signs, would be placed around the outside of affected areas and would not disturb areas of contamination above the cleanup levels. Confirmation monitoring of the condition of institutional controls would be required to confirm the condition and effectiveness of the control measures.

Other Requirements:

Permanent Solutions to the Maximum Extent Practicable: This cleanup action would not result in permanent reduction in the toxicity, mobility, or volume of hazardous substance at the site. Therefore, the institutional controls alternative would not provide permanent solutions to the maximum extent practicable. This alternative will not meet the requirements of MTCA because it relies primarily on institutional controls where it is possible to implement a more permanent cleanup action for all or a portion of the site.

Attaining Cleanup in a Reasonable Time: The institutional control alternative does not attain cleanup of the site in a reasonable time. Due to the elemental nature of the contaminant, the alternative does not cleanup the site in a reasonable time period.

Public Concerns: Public concerns would be addressed after receipt of public comments on the proposed cleanup action.

7.3.3 Alternative 3 – Containment (Capping)

Description of Alternative: The containment alternative refers to capping over areas where lead concentrations in soil exceed cleanup standards. The intent of the action would be to prevent dermal contact or ingestion of the affected soil by on-site workers and/or visitors. Depending on the material used for the cap, the action may also minimize chemical transport by rainwater infiltration. This alternative would contain the affected soil through placement of a cap over the affected areas. The cap would limit the potential exposure routes for human and ecological receptors. Some borrowing animals and plants with deep roots would remain potential receptors. Caps would be constructed of soil or more impermeable materials such as asphalt, concrete, or use of geomembranes.

This alternative would include minimum standards for construction of caps over contaminated soil. Capping would require clearing and grubbing of affected areas prior to placement of the cap. Deed restrictions would be recorded to advise potential owners of the property of the hazards and use limitations associated with the specific affected areas. Zoning and other permit restriction would be implemented to limit site uses to avoid potential exposure. Periodic site inspections would be required to verify the condition of caps and drainage features, and if required maintenance of the cap would be conducted.

Threshold Requirements:

Protection of Human Health and the Environment: Under the containment alternative, affected areas of the site would remain as they currently are with no reduction in toxicity or volume of impacted soils. The mobility of the contaminated soils would be reduced because the cap would act as a barrier for infiltration and also minimize the potential for dermal contact or ingestion.

Compliance with Cleanup Standards: The alternative may meet MTCA cleanup standards if all conditions in MTCA 340-740 (6)(f) are satisfied. Lead concentrations in soil above cleanup standards would be left on site; however, the soils would be contained to significantly reduce the potential for exposure. This alternative may not meet the requirement of being permanent to the maximum extent practicable.

Compliance with Applicable Laws: Implementation of this alternative would involve compliance with laws and regulations related to wastewater discharges, air discharges, or dangerous waste management. Deed restrictions and zoning changes would have to be implemented in accordance with local, county, and state laws and regulations.

Provision of Compliance Monitoring: The containment alternative would include protection monitoring during construction to confirm human health and the environment are adequately protected. Performance monitoring would be required during cap construction to confirm the cap meets design and construction specifications. Confirmation monitoring of the condition of the caps would be required to confirm their long-term condition and effectiveness.

Other Requirements:

Permanent Solutions to the Maximum Extent Practicable: This cleanup action would not result in permanent reduction in the toxicity or volume of hazardous substance at the site. Therefore, the containment alternative would not provide permanent solutions to the maximum extent practicable. This alternative will not meet the requirements of MTCA because it is possible to implement a more permanent cleanup action for all or a portion of the site.

Attaining Cleanup in a Reasonable Time: The containment alternative could reduce exposure to contaminated soil in a reasonable time; however, construction of a cap would not attain cleanup in a reasonable time period. The existing contamination would remain on site, but due to the elemental nature of the contaminant, the alternative does not cleanup the site in a reasonable time period.

Public Concerns: Public concerns would be addressed after receipt of public comments on the proposed cleanup action.

7.3.4 Alternative 4 – Consolidation and Containment (Capping)

Description of Alternative: The consolidation and containment alternative refers to consolidating affected soils in one or more areas on site and then constructing a cap over the contaminated soil. The intent of the action would be to prevent dermal contact or ingestion of the affected soil by on-site workers and/or visitors. Contaminated soils would be excavated and hauled to a suitable on-site location, compacted, and capped. Depending on the material used for the cap, the action may also minimize chemical transport by rainwater infiltration. This alternative would contain the affected soil through placement of a cap over the affected areas. The cap would limit the potential exposure routes for human and ecological receptors. Some borrowing animals and plants with deep roots would remain potential receptors. Caps would be constructed of soil or more impermeable materials such as asphalt, concrete, or use of geomembranes.

This alternative would include minimum standards for construction of caps over contaminated soil. Containment and capping would require clearing and grubbing of affected areas prior to excavation and consolidation of the contaminated soils. Deed restrictions would be recorded to advise potential owners of the property of the hazards and use limitations associated with the specific affected areas. Zoning and other permit restriction would be implemented to limit site uses to avoid potential exposure. Periodic site inspections would be required to verify the condition of caps and drainage features, and if required maintenance of the cap would be conducted.

Threshold Requirements:

Protection of Human Health and the Environment: Under the containment and capping alternative, affected areas of the site would remain as they currently are with no reduction in toxicity or volume of impacted soils. The mobility of the contaminated soils would be reduced because the cap would act as a barrier for infiltration and also minimize the potential for dermal contact or ingestion.

Compliance with Cleanup Standards: The alternative may meet MTCA cleanup standards if all conditions in MTCA 340-740 (6)(f) are satisfied. Lead concentrations in soil above cleanup standards would be left on site; however, the soils would be contained to significantly reduce the potential for exposure. This alternative may not meet the requirement of being permanent to the maximum extent practicable.

Compliance with Applicable Laws: Implementation of this alternative would involve compliance with laws and regulations related to wastewater discharges, air discharges, or dangerous waste management. Deed restrictions and zoning changes would have to be implemented in accordance with local, county, and state laws and regulations.

Provision of Compliance Monitoring: The consolidation and containment alternative would include protection monitoring during construction to confirm human health and the environment are adequately protected. Performance monitoring would be required during cap construction to confirm the cap meets design and construction specifications. In addition, performance monitoring would be conducted at areas where soil was excavated to confirm soils remaining (not consolidated) meet cleanup standards. Confirmation monitoring of the condition of the caps would be required to confirm the long-term condition and effectiveness of the caps.

Other Requirements:

Permanent Solutions to the Maximum Extent Practicable: This cleanup action would not result in permanent reduction in the toxicity or volume of hazardous substance at the site. Therefore, the consolidation and containment alternative would not provide permanent solutions to the maximum extent practicable. This alternative will not meet the requirements of MTCA because it is possible to implement a more permanent cleanup action for all or a portion of the site.

Attaining Cleanup in a Reasonable Time: The consolidation and containment alternative could reduce exposure to contaminated soil in a reasonable time; however, construction of a cap would not attain cleanup in a reasonable time period. The existing contamination would be consolidated and remain on site, but due to the elemental nature of the contaminant, the alternative does not cleanup the site in a reasonable time period.

Public Concerns: Public concerns would be addressed after receipt of public comments on the proposed cleanup action.

7.3.5 Alternative 5 – Excavation and Off-Site Disposal or Recycling

Description of Alternative: The excavation and off-site disposal or recycling alternative includes excavation of all soils above cleanup standards and disposing or recycling of the soils off site. The intent of the action would be to eliminate the potential for dermal contact or ingestion of the affected soil by on-site workers and/or visitors and to eliminate the potential exposure to ecological receptors. Contaminated soils would be excavated, mechanically screened to remove bullets, and soils above cleanup standards would be hauled off site for disposal or recycling.

Excavated soils from the ranges would be screened using vibrating screens to remove metal bullets, metal fragments, brass casings, rocks, and organic matter. The screened soils would be analyzed for lead concentrations and stockpiled on site. Screened soil will be disposed and/or recycled in accordance with legal requirements on the basis of the characterization results. The Army is evaluating recycling of the soil at other Army ranges and/or as using the soil in asphalt paving material. To the extent possible, recycling of non-hazardous soil would be conducted. All metal collected during soil sieving operations would be hauled off site for metal recycling. If recycling of lead and other metal fragments are not cost effective, the material would be sampled and profiled for proper disposal at an approved landfill.

This alternative would include minimum standards for excavation, screening, stockpiling, transporting, and disposal of contaminated soil with concentrations exceeding the cleanup standard. This alternative would require clearing and grubbing of affected areas prior to excavation. Screened soils would be sampled and analyzed to determine the appropriate disposition of the soil (hazardous or non-hazardous). Soils below cleanup standards would remain on site and be used as fill material in areas where excavations were conducted.

Threshold Requirements:

Protection of Human Health and the Environment: Under the excavation and off-site disposal or recycling alternative, affected areas of the site would be removed from the site. This cleanup action would result in permanent reduction in the toxicity, mobility, and volume of hazardous substance at the site. To the extent practicable, contaminated soil and lead removed from soil would be recycled. If excavated soils were determined to be hazardous, the soil would be stabilized prior to disposal in an RCRA approved landfill. Therefore, the excavation and off-site disposal or recycling alternative would provide the most permanent solution to the maximum extent practicable.

Compliance with Cleanup Standards: The alternative would meet MTCA cleanup standards because lead concentrations in soil above cleanup standards would be removed from the site.

Compliance with Applicable Laws: Implementation of this alternative would involve compliance with laws and regulations related to wastewater discharges, air discharges, or dangerous waste management. Lead screened from site soils is classified as scrap metal and is not regulated as solid waste or as hazardous waste when recycled. Under 40 CFR 261.6(a)(3)(ii), recycled scrap metal is classified as a recyclable material that is not subject to the requirements for generators, transporters, and storage facilities of hazardous wastes. Therefore, the lead reclaimed from the range soils does not need to be regulated or manifested as a hazardous waste during generation or transport to a recycling facility. Under current regulations, soils that are recycled are exempt from RCRA regulations if the resulting product is for use by the general public, contains recyclable materials that have undergone a chemical reaction so as to become inseparable by physical means, and meets Land Disposal Restriction treatment standards [40 CFR 266.20 (b)].

Provision of Compliance Monitoring: The excavation and off-site disposal or recycling alternative would include protection monitoring during construction to confirm human health and the environment are adequately protected. Performance monitoring would be required during excavation to confirm soils remaining meet cleanup standards. Confirmation monitoring would be combined with performance monitoring to confirm the effectiveness of the removal action.

Other Requirements:

Permanent Solutions to the Maximum Extent Practicable: This cleanup action would result in permanent reduction in the toxicity, mobility, and volume of hazardous substance at the site. Therefore, the alternative would provide permanent solutions to the maximum extent practicable. This alternative meets the requirements of MTCA because it implements a more permanent cleanup action for all or a portion of the site.

Attaining Cleanup in a Reasonable Time: The alternative could attain cleanup standards in a reasonable time period. Implementation of the alternative would be most successful if the excavated and screened soil were dry so that mechanical screens do not become clogged with wet soil. Therefore, the alternative may be limited to the summer season, but still could be attained in a reasonable time.

Public Concerns: Public concerns would be addressed after receipt of public comments on the proposed cleanup action.

7.4 Permanence Evaluation

The Permanence evaluation specifies consideration and comparison of each candidate alternative using seven criteria specified in WAC 173-340-360 (3) (f). The following discussion provides these comparisons in narrative format.

- Protectiveness: Alternate 5 is clearly superior in protectiveness of both human health, the environment, and attainment of cleanup standards as this alternate involves the recycling of recoverable lead, the removal, treatment and proper disposal of any hazardous materials, and the removal to an appropriate offsite facility of soils exceeding the cleanup standard for lead. Alternative 4 is less protective in that it involves consolidating the materials to one on-site location and providing a protective cover. Alternative 3 is still less protective in that the materials would be left in place with covers installed at each material location. Alternatives 1 and 2 are least protective in that they do not involve any physical action to remove, consolidate, treat, or cover the lead-containing soils.

- Permanence: Alternate 5 is clearly superior in permanence as this alternate involves the permanent actions in the form of recycling of recoverable lead, treatment and proper disposal of hazardous materials, and removal of soils exceeding the cleanup standard for lead. Alternative 3 and 4 are less permanent in that both involve maintenance of the protective cover(s). Alternatives 1 and 2 are least permanent in that they do not involve any physical action to remove, consolidate, treat, or cover the lead-containing soils.

- Cost: The five alternatives are ranked in numerical order from least to highest cost. However, Alternatives 3, 4, and 5 would be relatively comparable in overall cost when the long-term costs associated with cap maintenance are considered. As noted above, this RI/FS does not advance a disproportionate cost analysis.

- Effectiveness Over the Long Term: Alternative 5 is clearly superior over the long term since this is the only alternative that involves removal of soils with lead concentrations exceeding the cleanup standards. The long-term effectiveness of Alternatives 3 and 4 is clearly limited by the degree to which cap maintenance can be assured. The long-term effectiveness of Alternatives 1 and 2 is very low since these alternatives do not involve any physical remedial actions.

- Management of Short-Term Risks: Alternatives 3, 4, and 5 involve some short-term risk to workers implementing the removal, consolidation, and or capping; however, that risk will be mitigated by health and safety programs meeting OSHA and MTCA standards. Alternative 5 also involves some short-term risks associated with off-site transportation of recycled lead and lead containing soils; however transportation practices and emergency response mechanisms are in place to mitigate these risks. Alternatives 1 and 2 present no additional short-term risk since they do not involve any physical remedial action.

- Technical and Administrative Implementability: Alternative 5 ranks very high in terms of Implementability since it involves the application of proven technologies, the use or readily available personnel, equipment, and supplies, and the use of existing disposition facilities. Alternatives 3 and 4 are technically implementable for the same reasons; however there is a significant administrative issue arising from the requirement to leave lead-containing materials on site. Alternatives 1 and 2 are technically implementable as they do not involve any physical actions; however they raise major administrative issues.

- Consideration of Public Concerns: Alternative 5 is expected to address most public concerns since the lead and soils exceeding the cleanup standard will be removed from the site. Alternatives 1 through 4 all raise significant public concerns as they involve leaving these materials on-site in locations that will be in or near the proposed public recreation areas.

Table 7-1 Revised Volume Estimates

Small Arms Range Designation	Volume of Impacted Grids (cubic yards) > 50mg/kg
Close Combat Range	30
25 Meter M60 /Pistol Range	486
Sub Machine Gun Range	0
TF Range	0
Rifle Range 1 & 2	3,119
Field Fire Rifle Ranges 1 & 2	372
Infiltration Course North	0
Field Firing Ranges 1&2 &Pistol	868
Undocumented Pistol Range	52
1,000 ft Range, 1,000 Machine	3,315
Combat Pistol Range	493
Machine Gun Range North	268
Machine Gun Range South	59
M31 Sub-Caliber Ranges 1 & 2	30
25 m & Machine Gun Range	2,080
Infiltration Course South	59
25M Record Fire Field Range	1,331
Total (cubic yards)	**12,562**

7.5 Summary and Recommendations

The evaluation of the five candidate alternative action is summarized as follows:

- Alternative 1 – No Action does not meet the threshold requirements.
- Alternative 2 – Institutional Controls partially meets the threshold requirements and is ranked very low in terms of permanence.
- Alternative 3 - Containment and Alternative 4 - Consolidation and Containment – meet the threshold requirements except for consideration of public concerns and ranks lower in terms of permanence than Alternative 5.
- Alternative 5 – Excavation and Off-site Disposal or Recycling meets the threshold requirements, addresses public concerns, and ranks highest in terms of permanence.

Therefore, the recommended alternative for remediation of site soils is excavation and removal of contaminated soil.

The selected cleanup alternative – Alternative 5 – provides the most permanent solution to the contaminated soil at the Small Arms Ranges. Metallic, particulate lead will be removed by post-excavation screening and recycled. Highly contaminated soils with lead concentrations exceeding TCLP criteria will be stabilized prior to disposal in an approved landfill. Less contaminated soils will be removed to an appropriate residual waste landfill. Due to the nature of the contamination, this cleanup alternative offers the most permanent solution for cleaning up lead contaminated soil. Therefore, a disproportionate cost analysis specified in WAC 173-340-360 (3) is not appropriate since it is obvious that the selected alternative uses permanent solutions to the maximum extent practicable. That is, the selected alternative when compared to the other alternatives more favorable satisfies the evaluation criteria: protectiveness, permanence, short and long term effectiveness, implementability, and public concerns.

It is proposed that the 11,300 cubic yards proposed for remediation be managed according to Alternate 5. Table 7-1 identifies these soil volumes by Small Arms Range location.

Due to concerns related to the potential presence of munitions and explosives of concern (MEC) at these Small Arms Ranges, this remedial action should be implemented in two stages, as follows:

- An Interim Cleanup Action consisting of brush removal and a MEC clearance.

- A Final Cleanup Action consisting of soil excavation, confirmatory testing to verify excavation completion, excavated soils screening, recovered lead recycling, excavated soils testing for disposal management, and excavated, categorized soils disposal at appropriate treatment and/or disposal facilities.

8.0 REFERENCES

AEM 2003a. Work Plan for Soil Sampling in Firing Ranges and Demolition Areas 2 and 3, Sampling and Analysis Plan – Soil, Quality Assurance Project Plan, Site Safety and Health Plan, Data Management Plan, and Waste Management and Minimization Plan. Prepared for U.S. Army Engineering District Norfolk, Norfolk, Virginia. Prepared by Atlanta Environmental Management. 17 February 2003.

AEM, 2003b. Draft Site Investigation Report, Small Arms Ranges and Demolition Areas 2 and 3. Camp Bonneville, Vancouver, Washington. Prepared for U.S. Army by Atlanta Environmental Management (AEM). April 18, 2003.

Ecology, 1994. Natural Background Soil Metals Concentrations in Washington State, Toxics Cleanup Program, Dept. of Ecology, Publication #94-115. Figure 51, page 12-10.

Ecology, 2001. Cleanup Levels and Risk Calculations under the Model Toxics Control Act Cleanup Regulations (CLARC). Version 3.1. Part II, Soil Cleanup Levels for Unrestricted Land Use, Table 2. Publication No. 94-145. November 2001.

Environmental Science and Engineering, Inc. 1983. Installation Assessment of the HQ, I Corps and Ft. Lewis, Washington and the Sub installation Yakima Firing Center, Camp Bonneville, and Vancouver Barracks.

Geo Recon International. 1981. Cultural Resources Survey, Forest Management Project, Ft. Lewis and Camp Bonneville, Washington, for U.S. Army, Ft. Lewis.

Hart Crowser. 1996. Petroleum Contaminated Soil Investigation, Former Tank no.7-CMBPN, Building no. 4475, Camp Bonneville Washington. Contract No. DACA67-93-D-1004. September 1996.

Hart Crowser. 2000. Final Project Completion Report Surface Water Investigation of Lacamas Creek. Camp Bonneville, Vancouver, Washington. Prepared for US Army Corp of Engineers, Seattle District. March 10, 2000.

Interstate Technology and Regulatory Council (ITRC). 2003. Technical and Regulatory Guidelines. Characterization and Remediation of Soils at Closed Small Arms Firing Ranges. Prepared by ITRC, Small Arms firing Range Team.

Larson, Lynn L. 1980. Cultural Resource Reconnaissance of Forest Management Tracts on Fort Lewis and Camp Bonneville. Office of Public Archaeology, Institute for Environmental Studies, University of Washington, Reconnaissance Report No. 34.

Miles 1972. Miles, C.D., et. al. Inhibition of Photosystem II in Isolated Chloroplasts by Lead. Plant Physiology 49:820-825.

Mundorff, MR. 1964. Geology and groundwater conditions of Clark County, Washington, with a description of major alluvial aquifer supply along the Columbia River: U.S. Geological Survey Water Supply Paper 1600, 268 p.

Oak Ridge National Laboratory (ORNL). 1997. Toxicological Benchmarks for Screening Potential Contaminants of concern for effects on Terrestrial Plants. 1997 Revision.

Phillips, WIMP. 1987. Geologic map of the Vancouver quadrangle, Washington and Oregon: Washington Division of Geology and Earth Resources Open File Report 87-10, scale 1:100,000.

Project Performance Corporation. 2003. Work Plan for Interim Actions at Small Arms Range Berms and Fire Support Areas. Camp Bonneville, Vancouver, Washington. Draft. March 31, 2003.

Shannon & Wilson. 1999a. Final Report Volume 1 Multi-Sites Investigations, Camp Bonneville, Washington. Contract No. DACA 67-94-D-1014. July 1999.

Shannon & Wilson 1999b. Final Landfill 4 Investigation Report, Camp Bonneville, Washington. Contract DACA 67-94-D-1014. August 1999.

URS. 2001. Expanded Site Investigation, Landfill 4 Demolition Area 1, Camp Bonneville, Vancouver, Washington. May 2001.

Venkatakrishnan, R., Bond, J. G., and Kauffman, J.D., 1980. Geologic Linears of the Northern Part of the Cascade Range, Oregon. State of Oregon, Department of Geology and Mineral Industries. Special Paper 12.

FIGURES

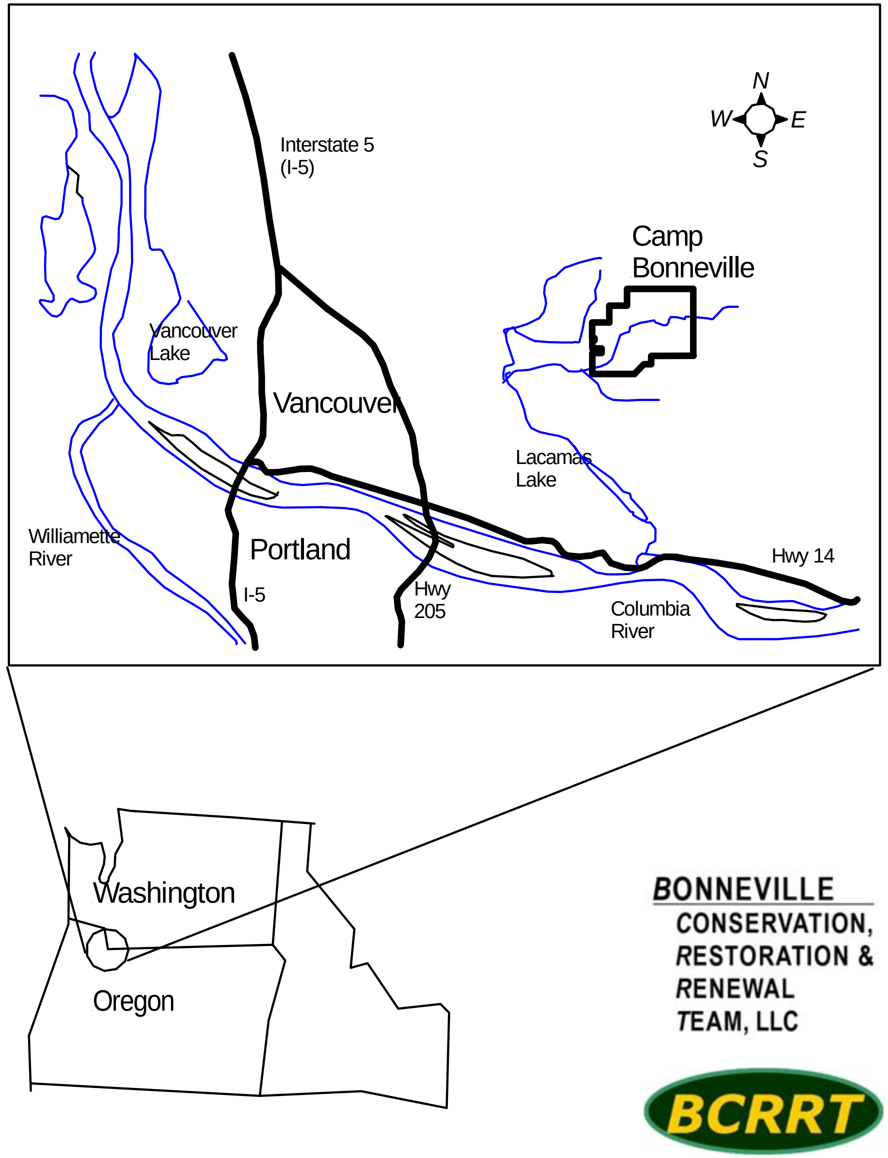

Figure 1. Camp Bonneville Site Location

Figure1-1 skf

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Figure 2
Small Arms Ranges

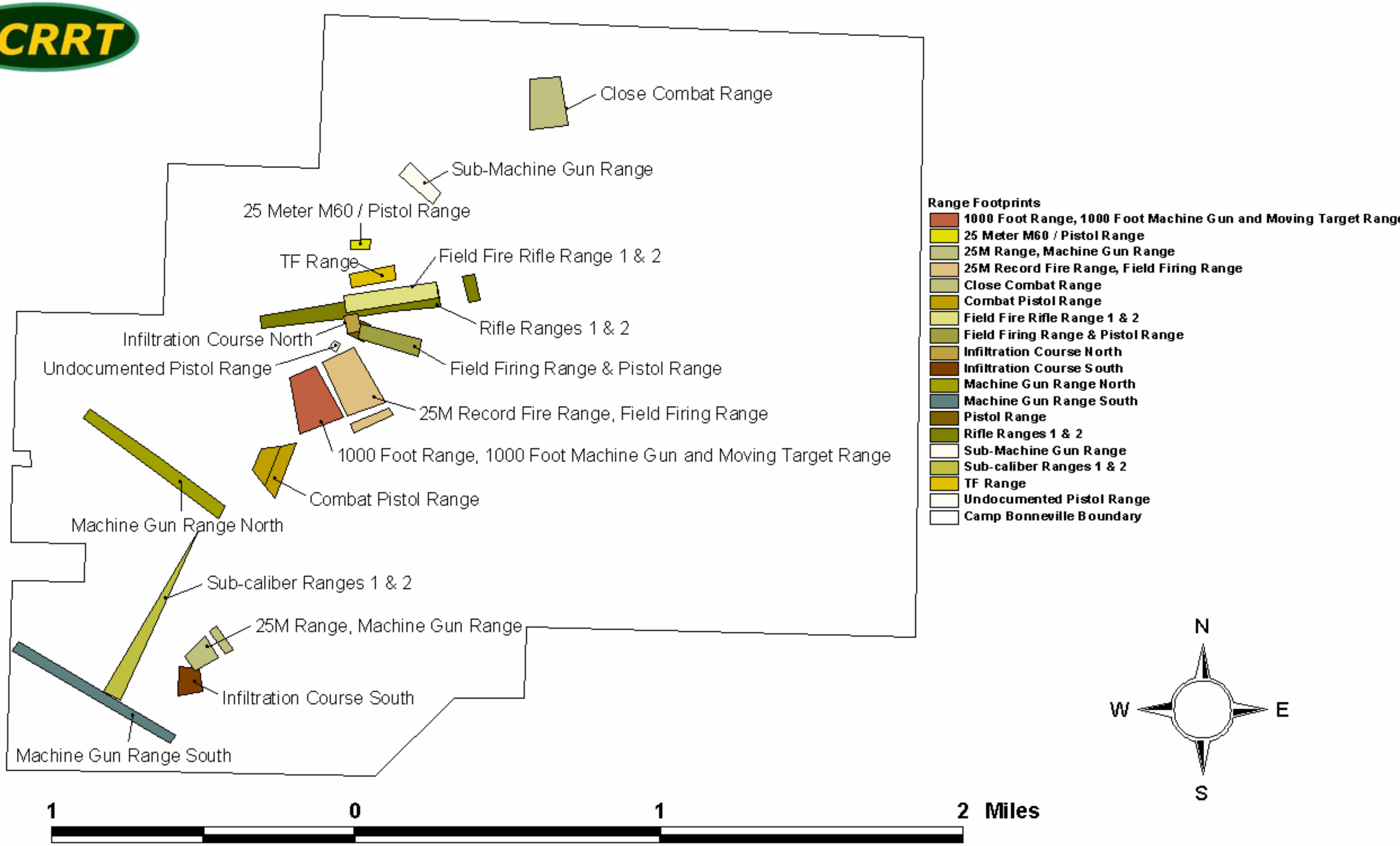

Figure 3
Camp Bonneville Topography

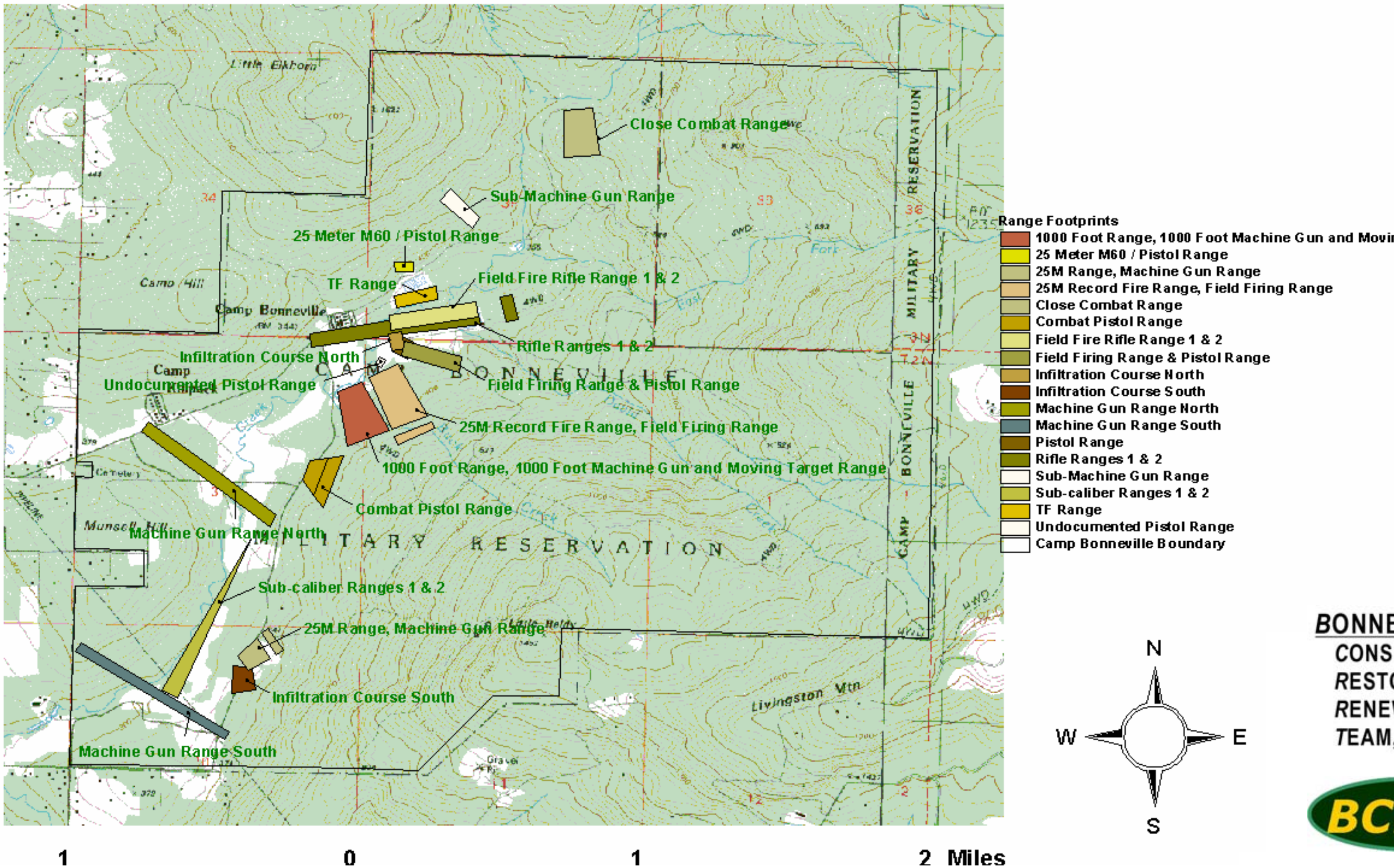

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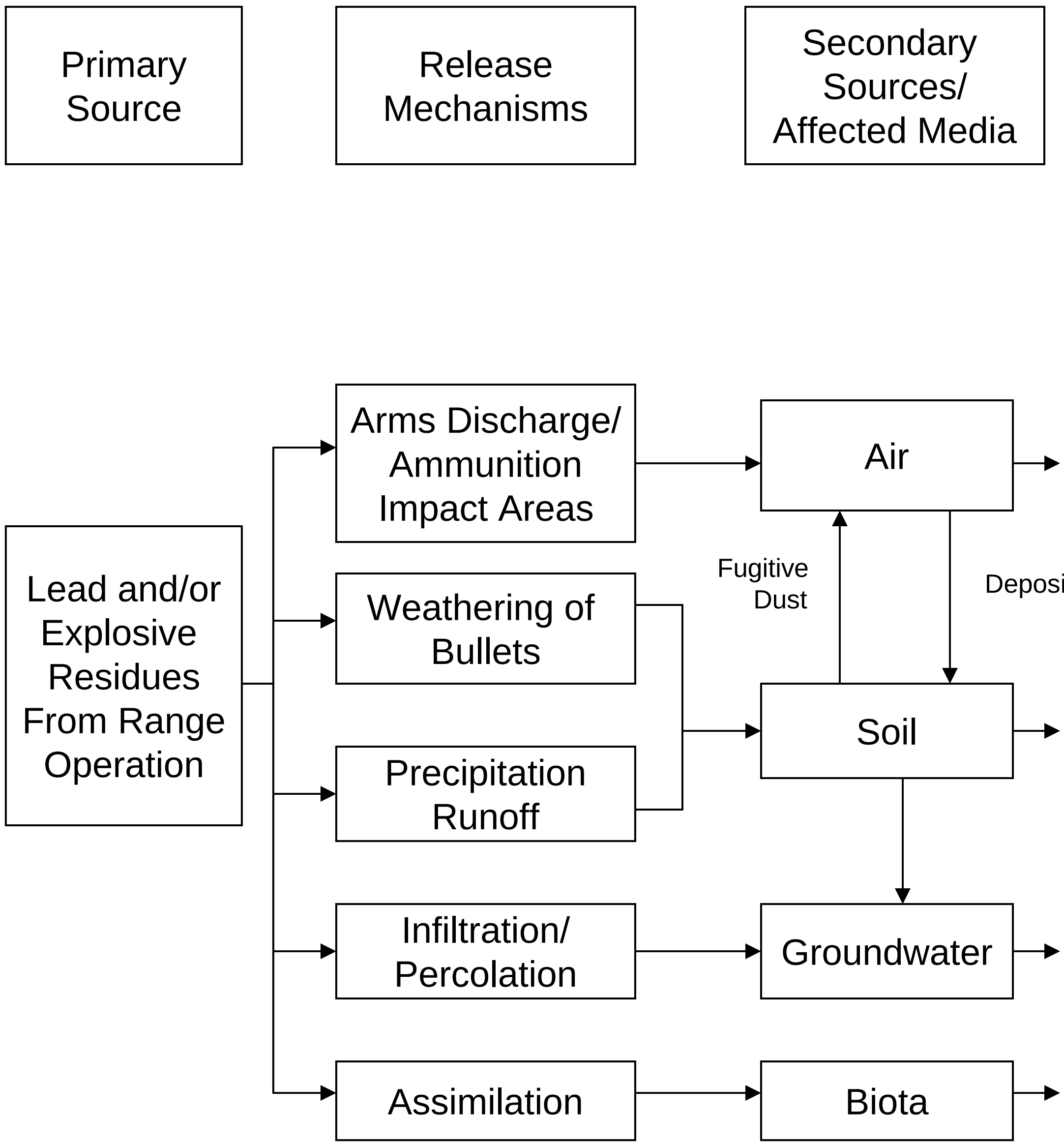
Figure 4
Conceptual Site Model
Potential Exposure Pathways at Small Arms Ranges



Secondary Source	Exposure Route	Human: Nonintrusive Worker	Human: Intrusive Worker	Human: Visitor	Ecological Terrestial: Terrestrial Plants	Ecological Terrestial: Soil Invertebrates	Ecological Terrestial: Aviary/Mammalian Omnivores	Ecological Terrestial: Aviary/Mammalian Carnivores
Air	Inhalation	●	●	●		●	●	●
Soil	Ingestion	●	●	●		●	●	●
Soil	Dermal Contact	●	●	●		●	●	●
Soil	Uptake (Plants)				●			
Groundwater	Ingestion	●		●				
Groundwater	Dermal Contact		●	●				
Groundwater	Uptake (Plants)				●			
Biota	Ingestion					●	●	●

Current/Future Potential Receptors

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Figure 5
Close Combat Range

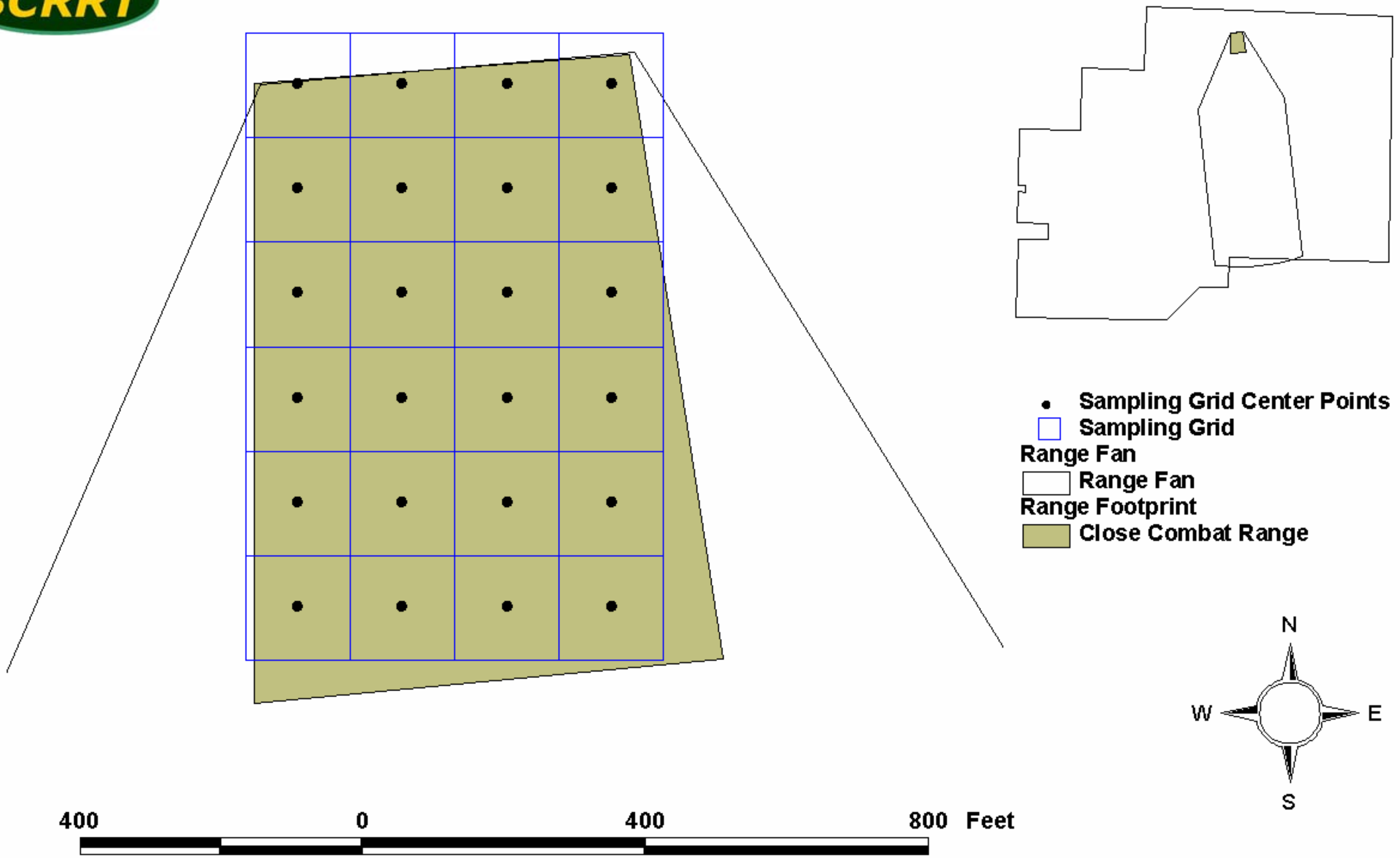

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Figure 6
25-m M60 Range/Pistol Range

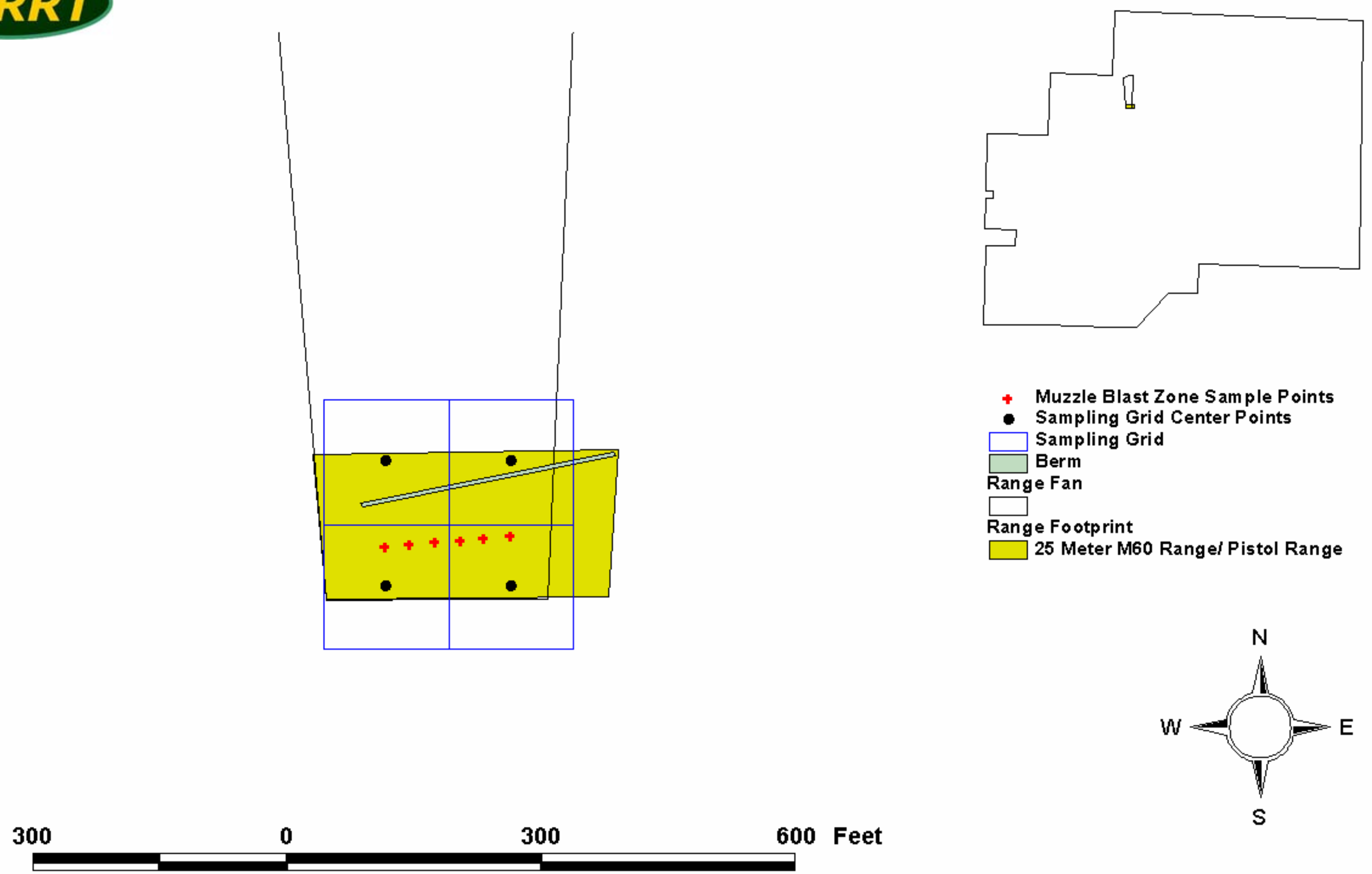

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Figure 7
Sub Machine Gun Range

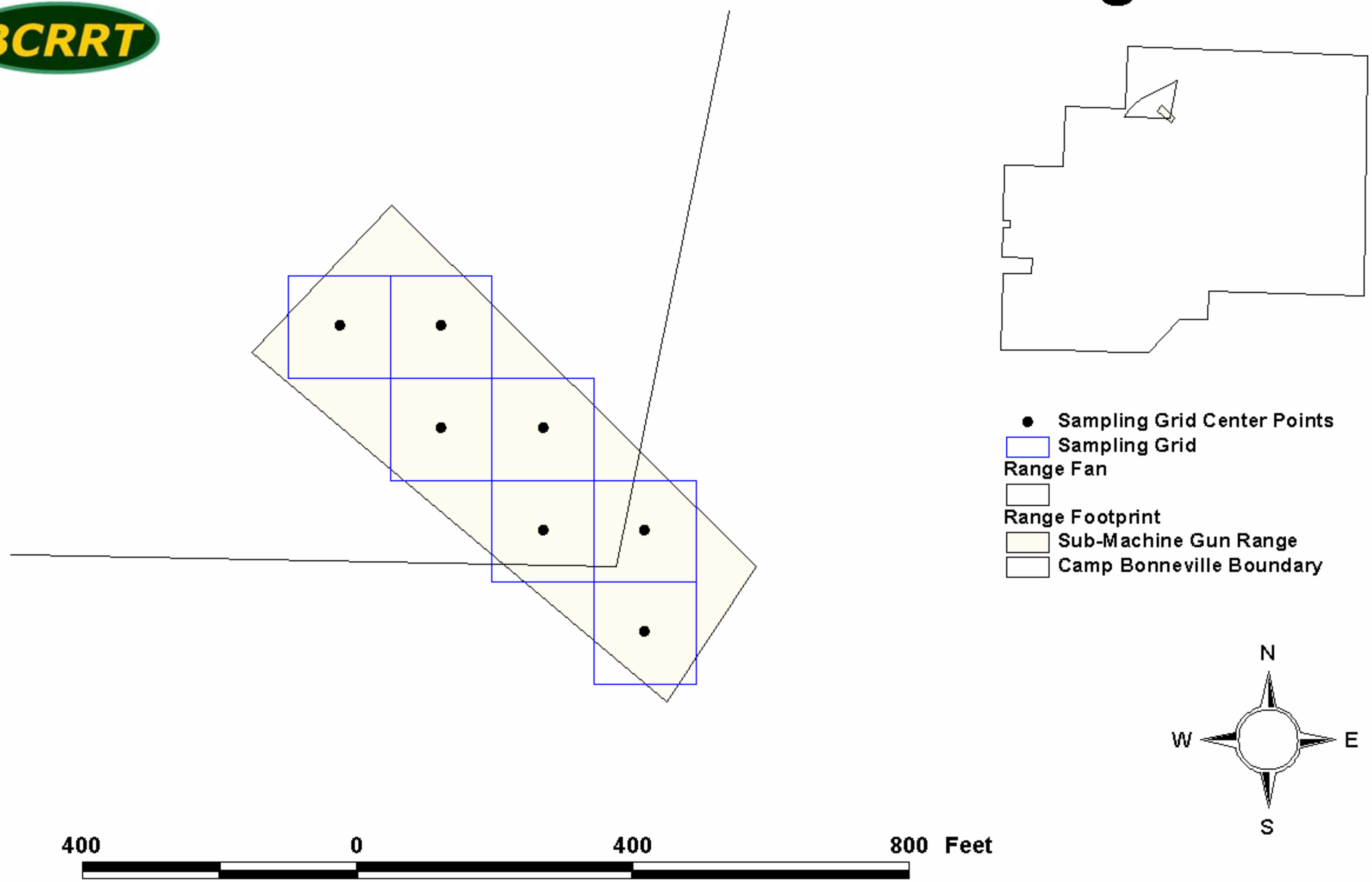

Figure 8
TF Range

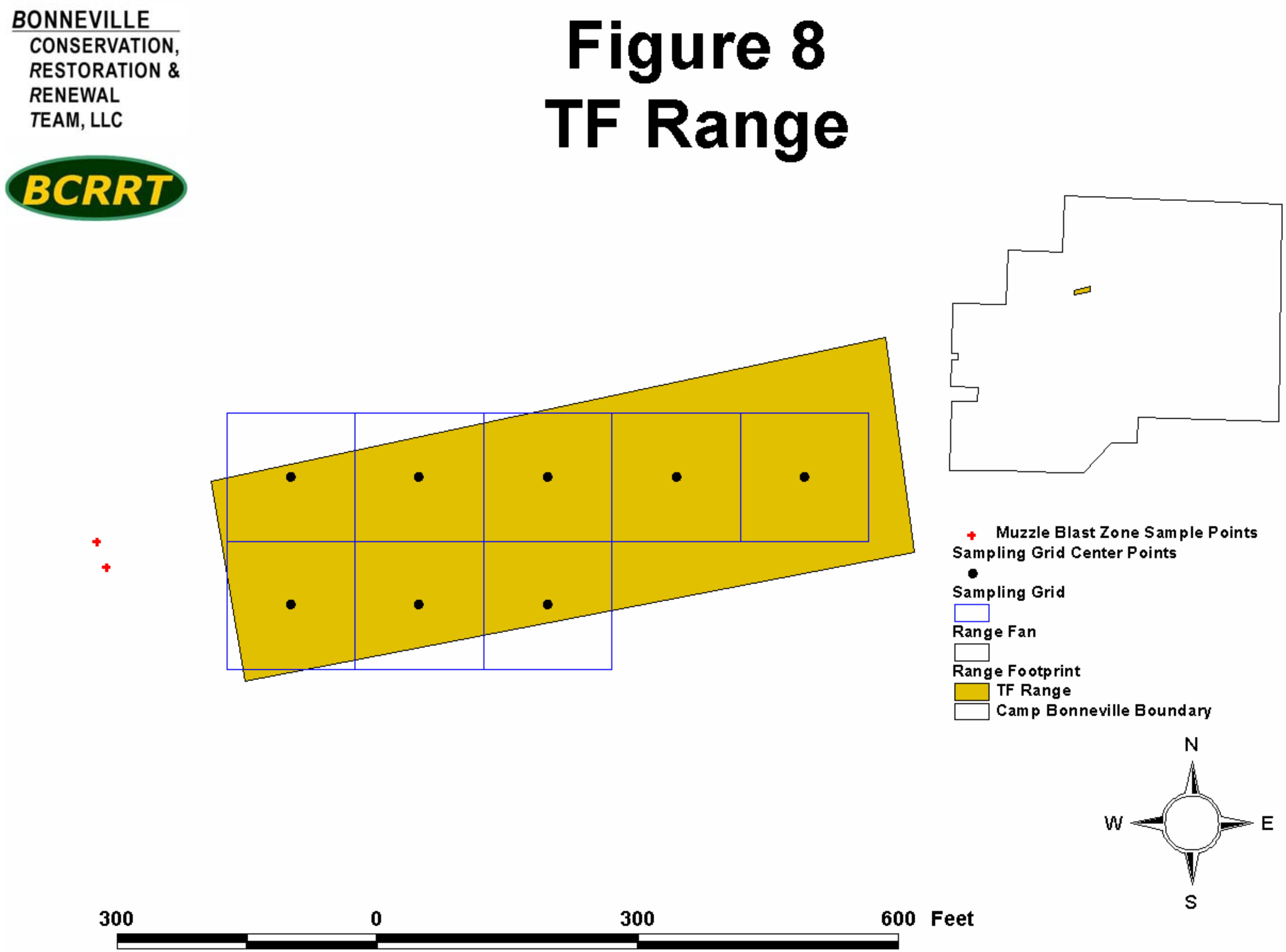

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Figure 9
Rifle Ranges 1 & 2

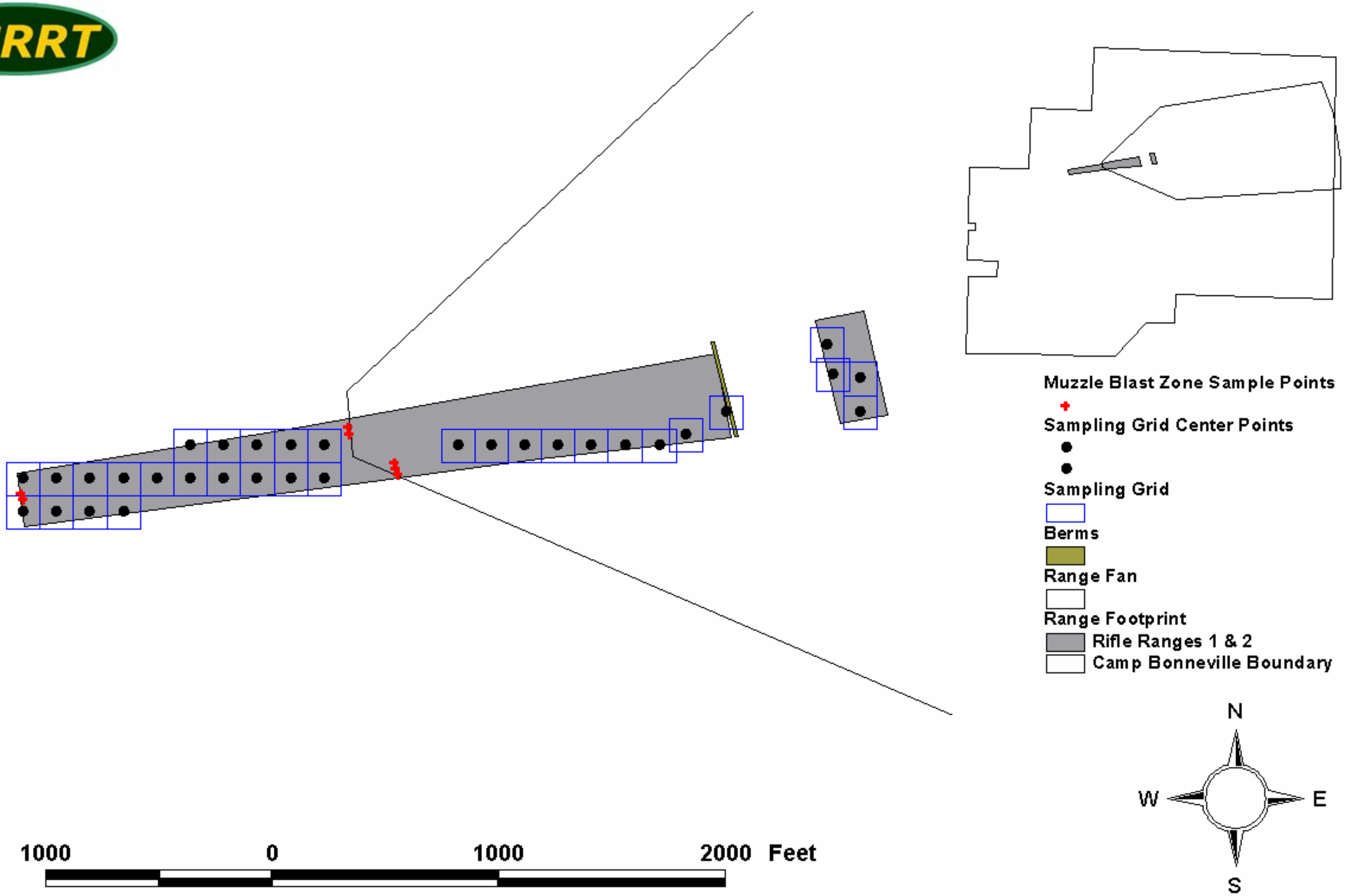

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Figure 10
Field Fire Rifle Range 1 & 2

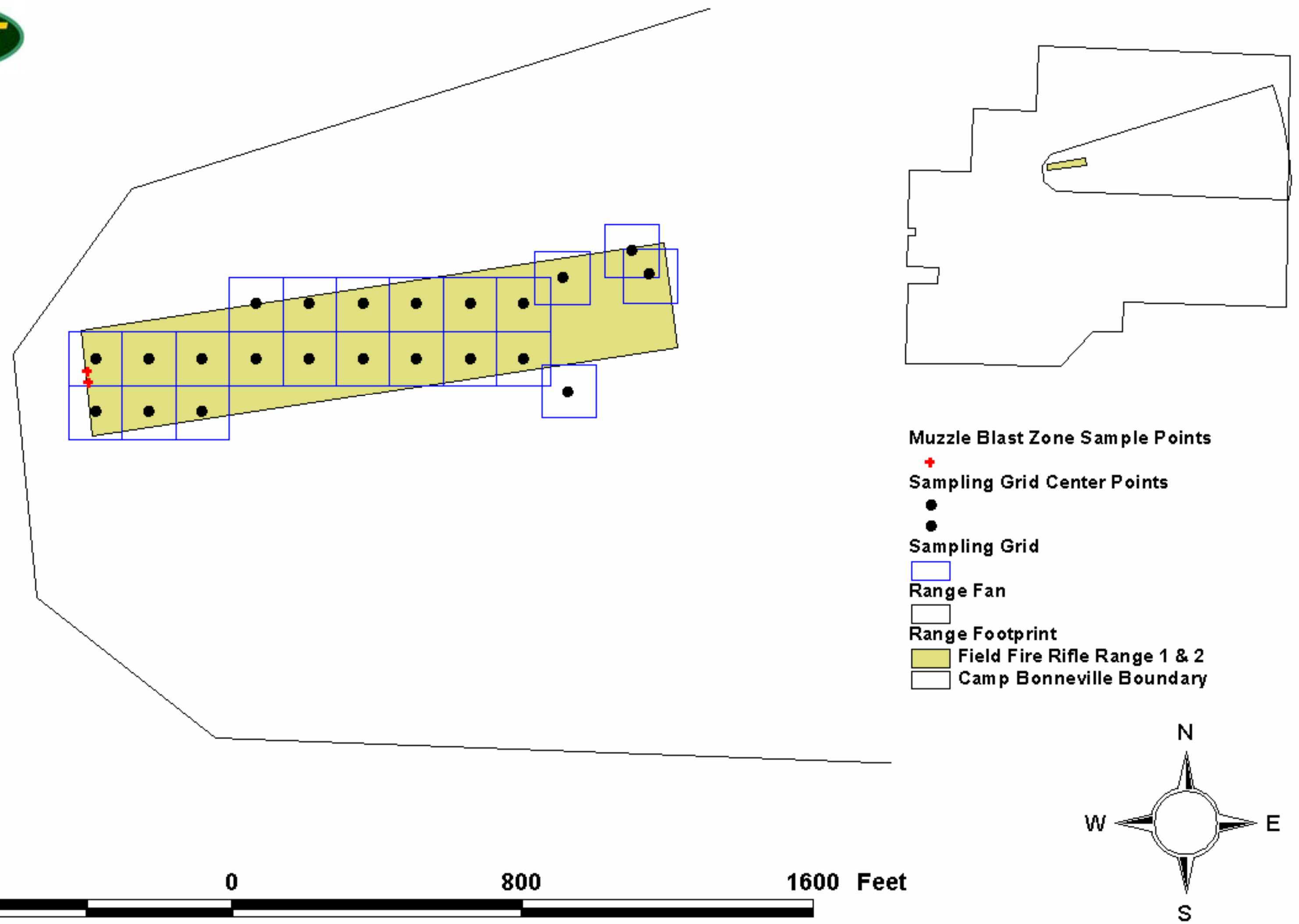

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Figure 11
Infiltration Course North

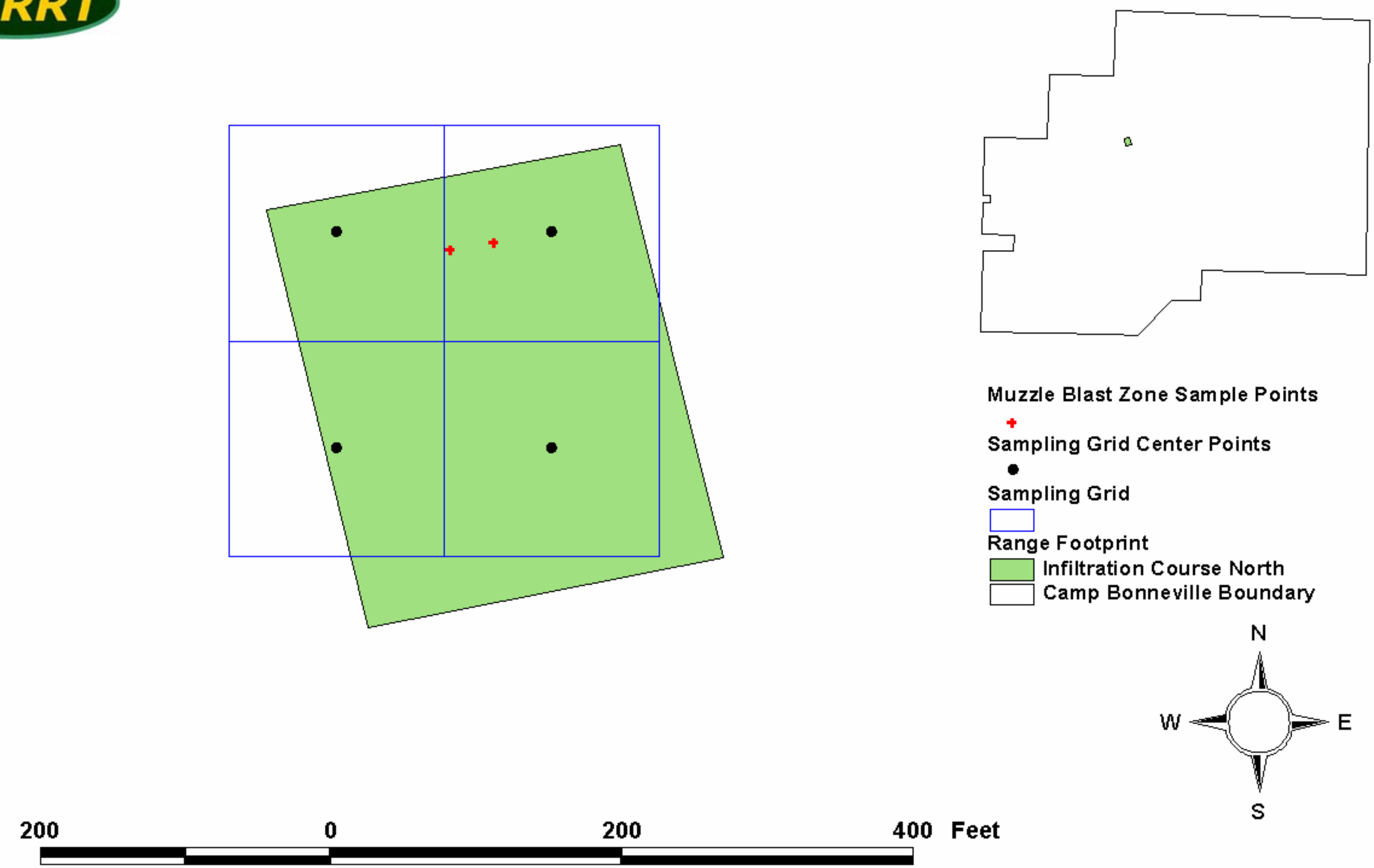

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Figure 12
Field Firing Ranges, Pistol Range, and Undocumented Pistol Range

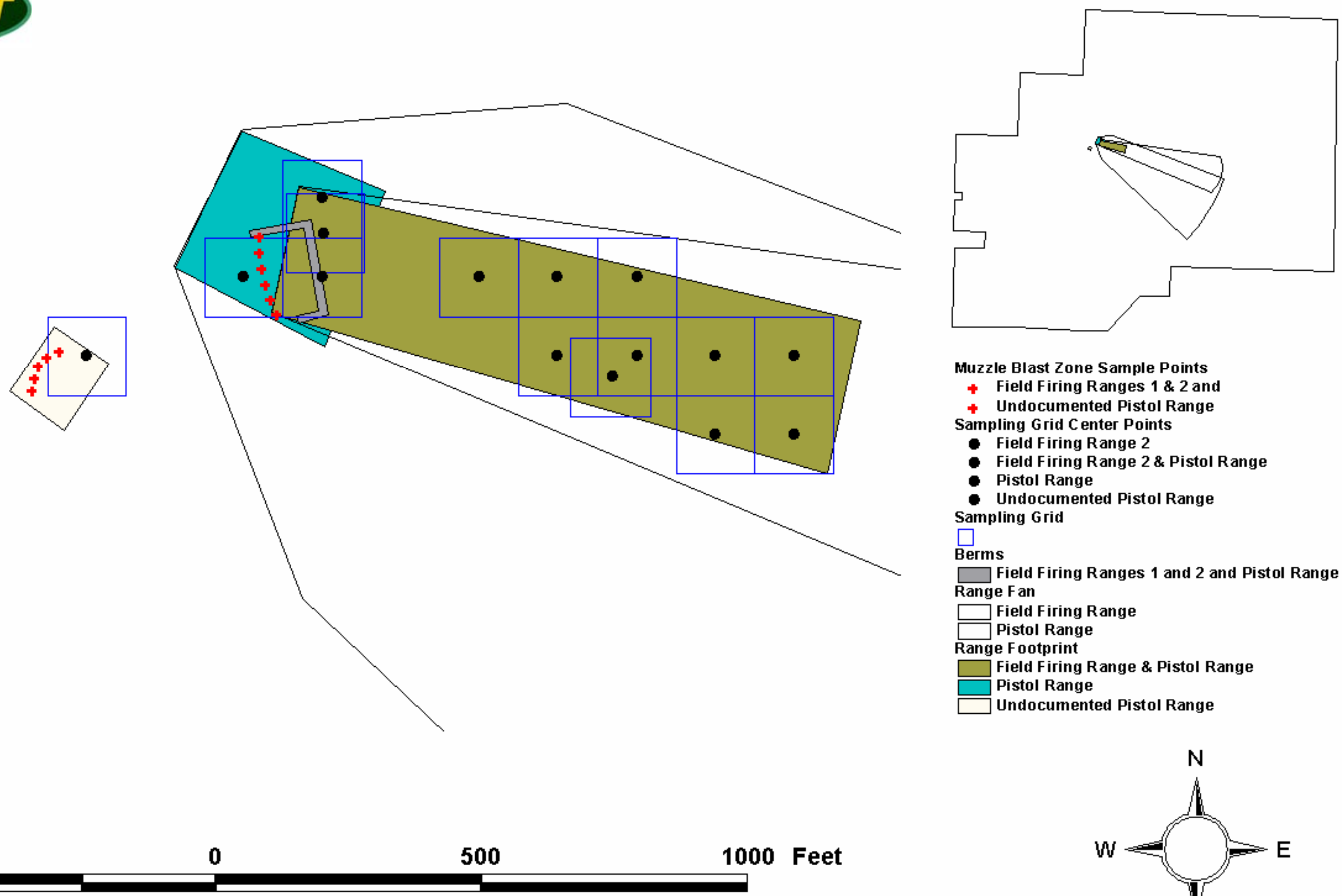

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Figure 13
1000-ft Range, 1000-ft Machine Gun and Moving Target Range

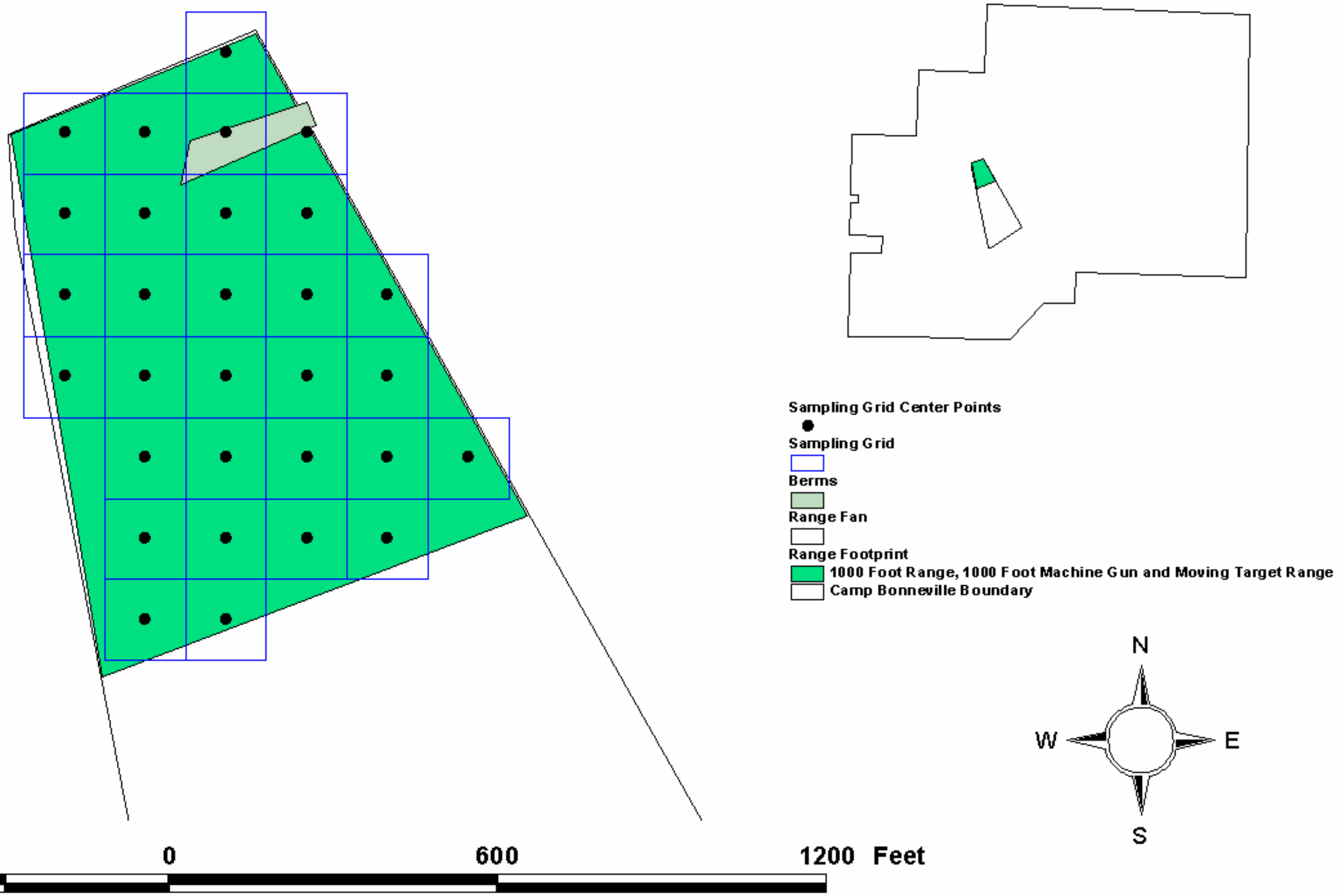

Figure 14
Combat Pistol Range

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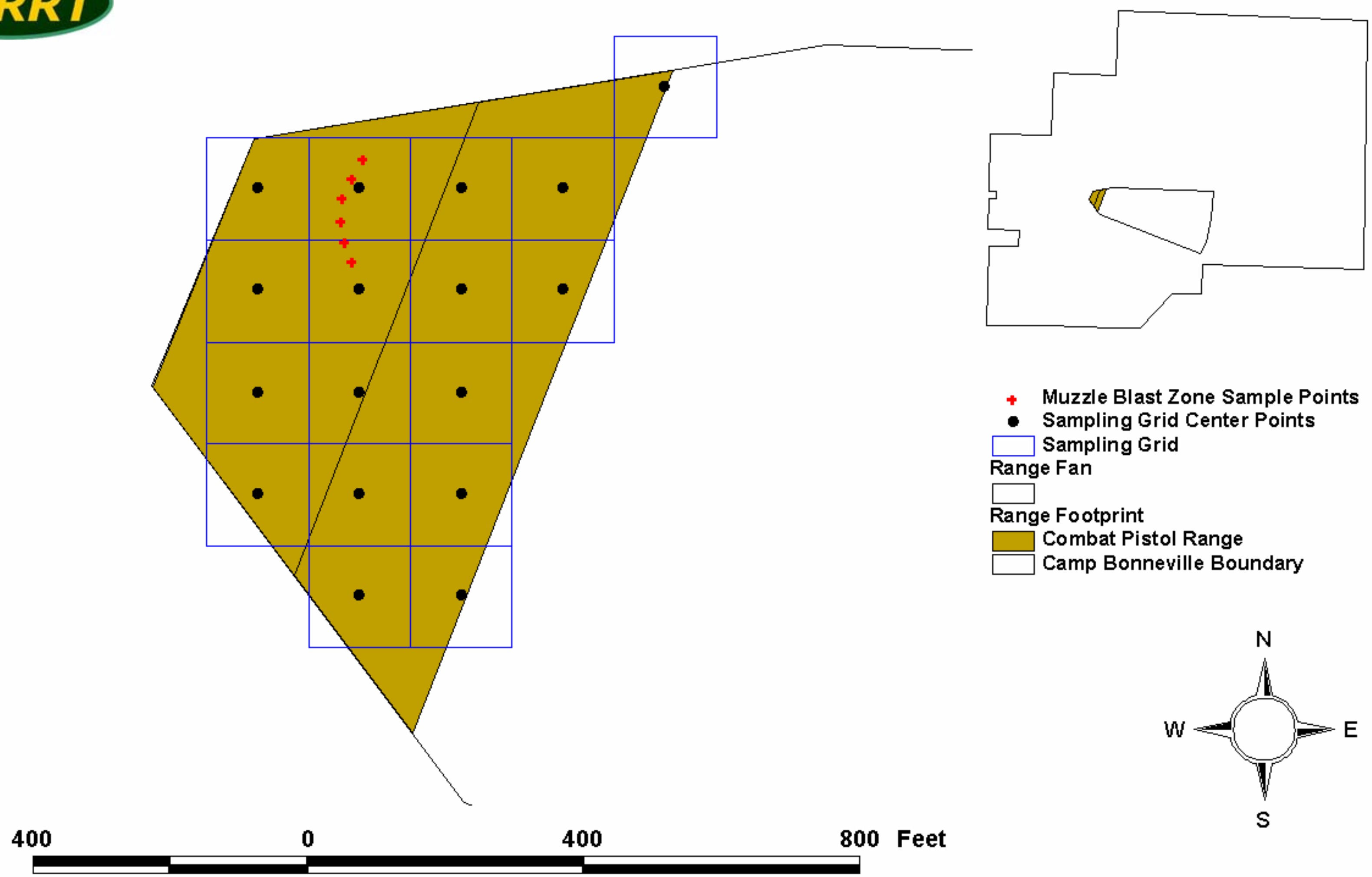

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Figure 15
Machine Gun Ranges (North and South)

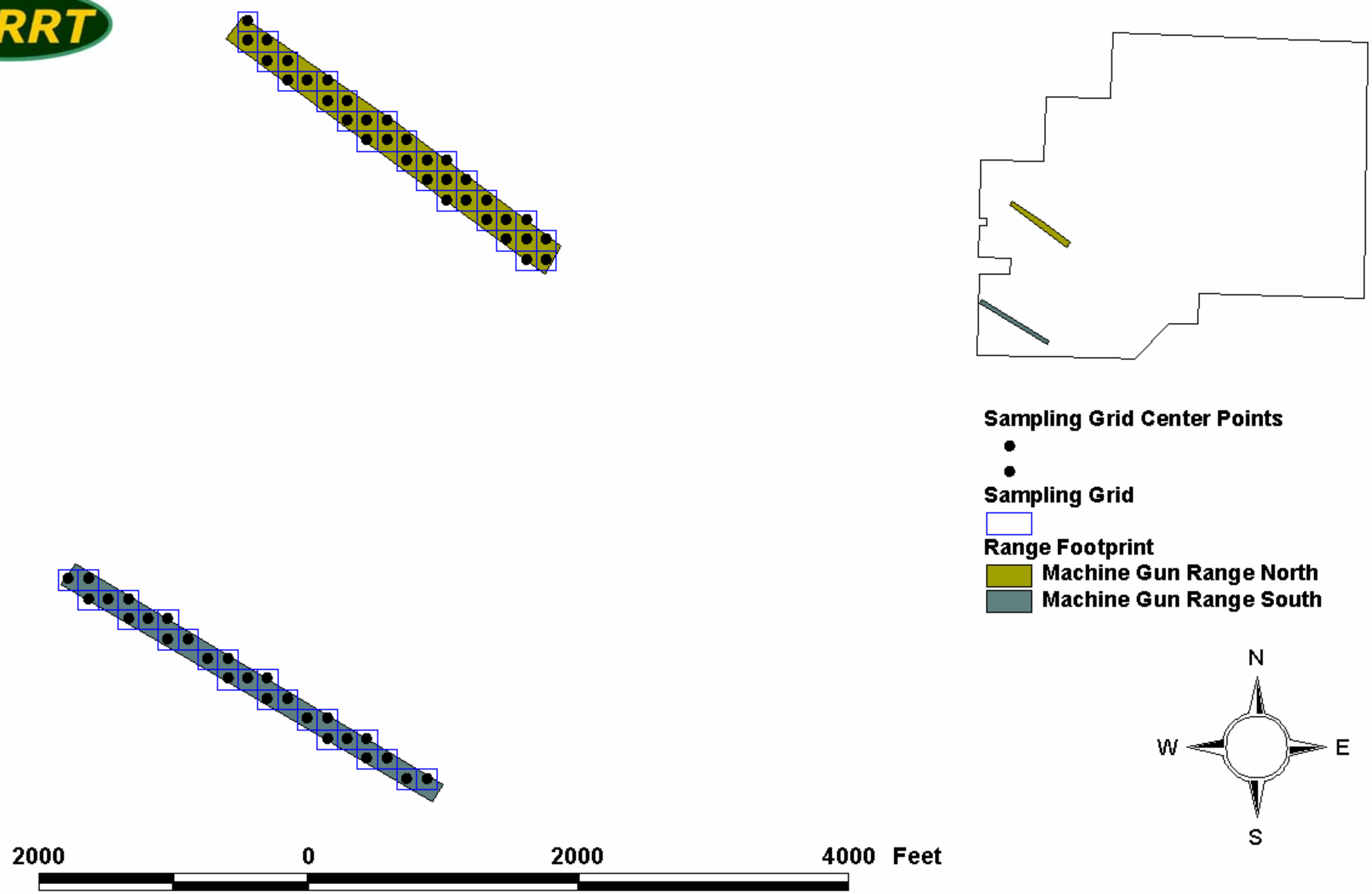

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Figure 16
M31 Sub-Caliber Ranges 1 & 2

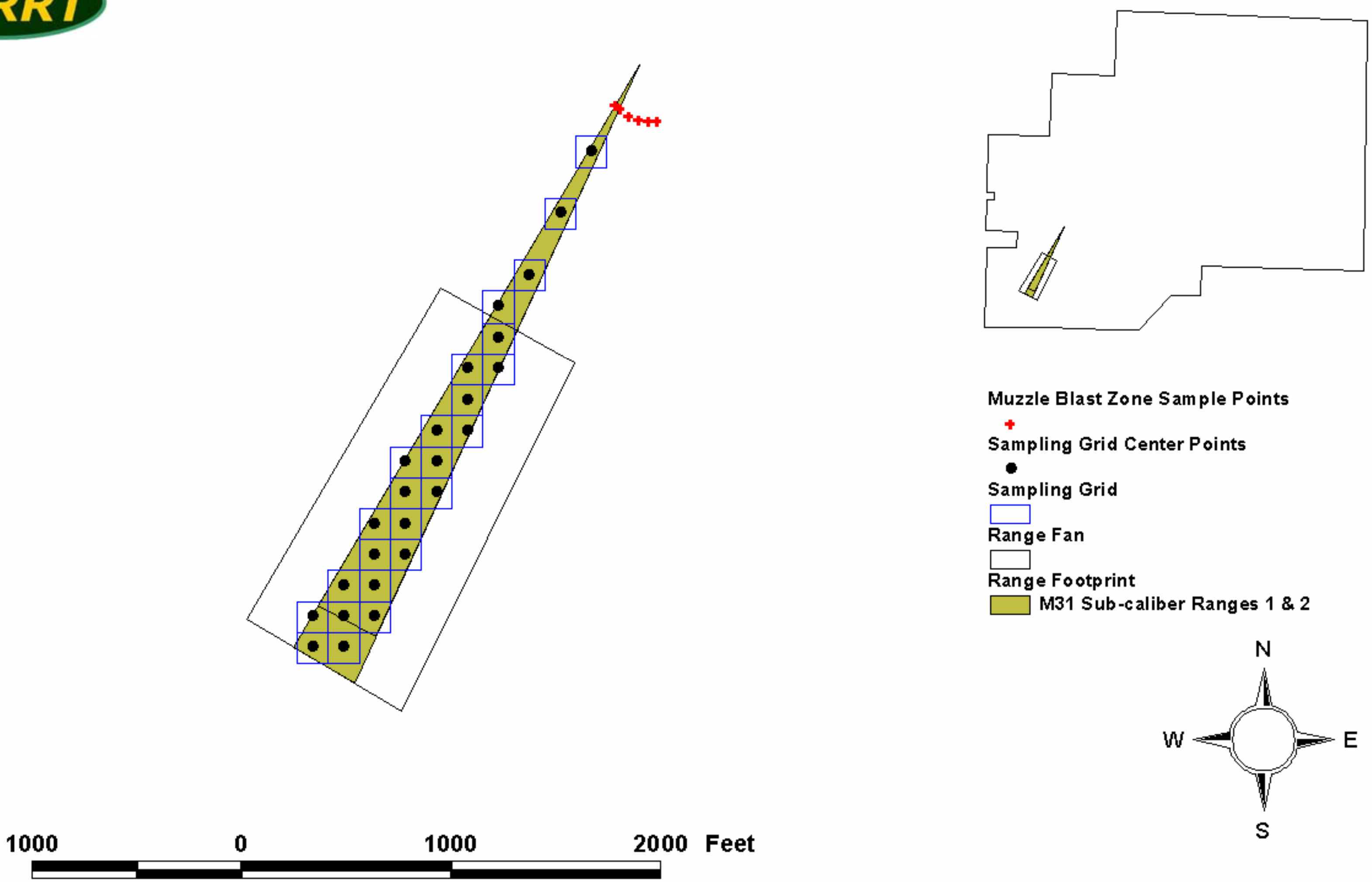

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Figure 17
25-m and Machine Gun Range

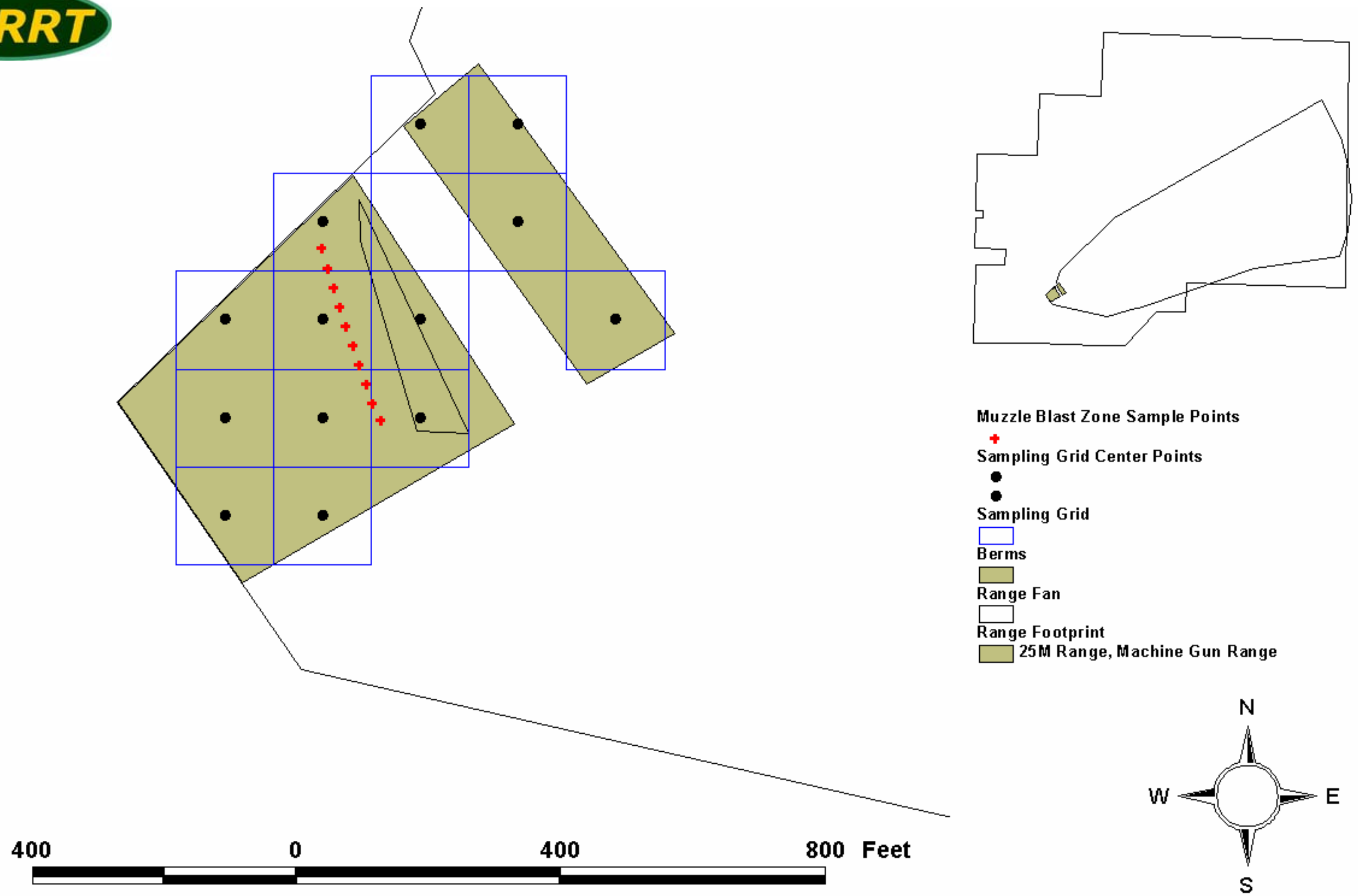

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Figure 18
Infiltration Course South

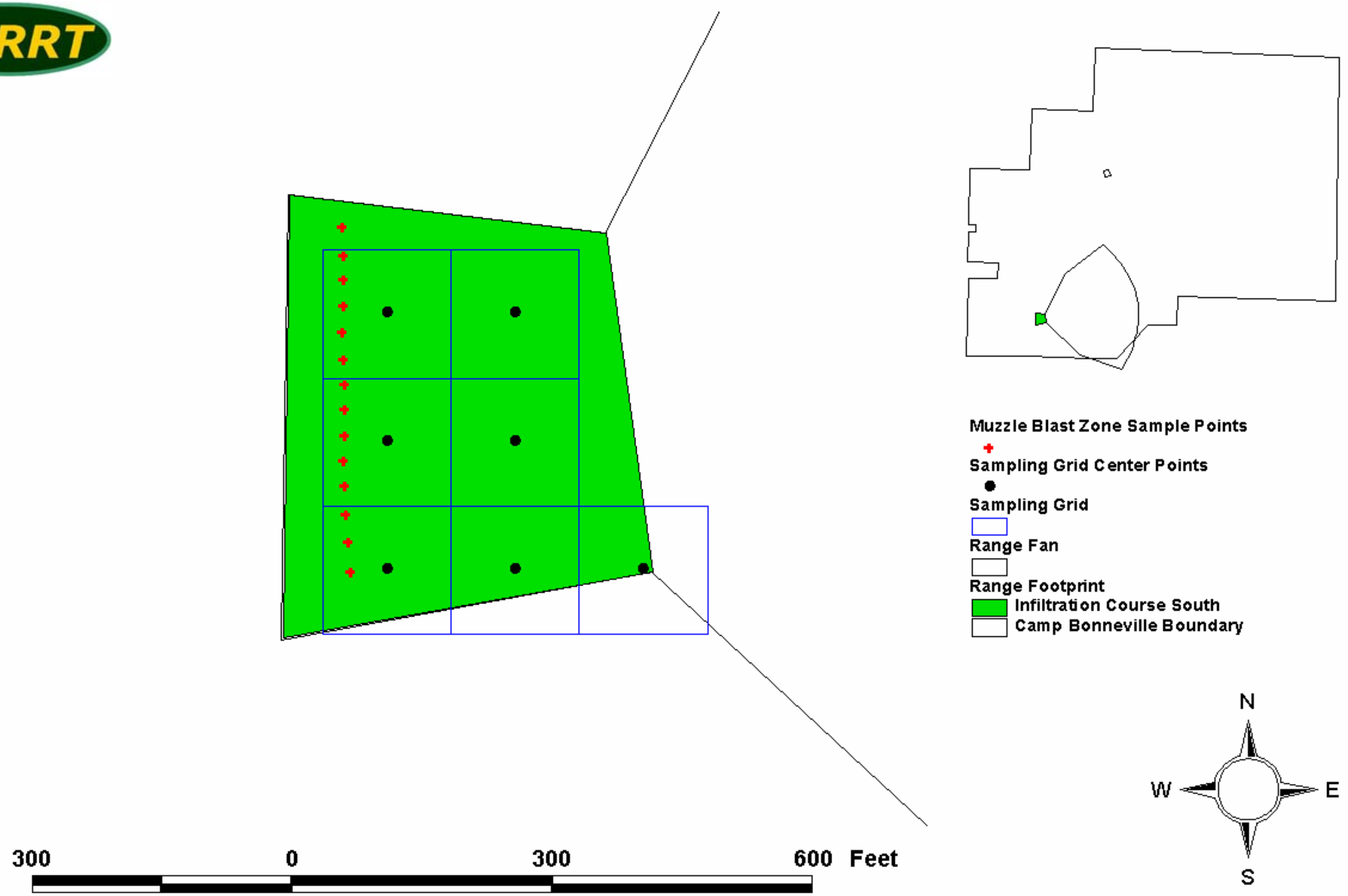

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Figure 19
25M Record Fire Field Range, Field Firing Range

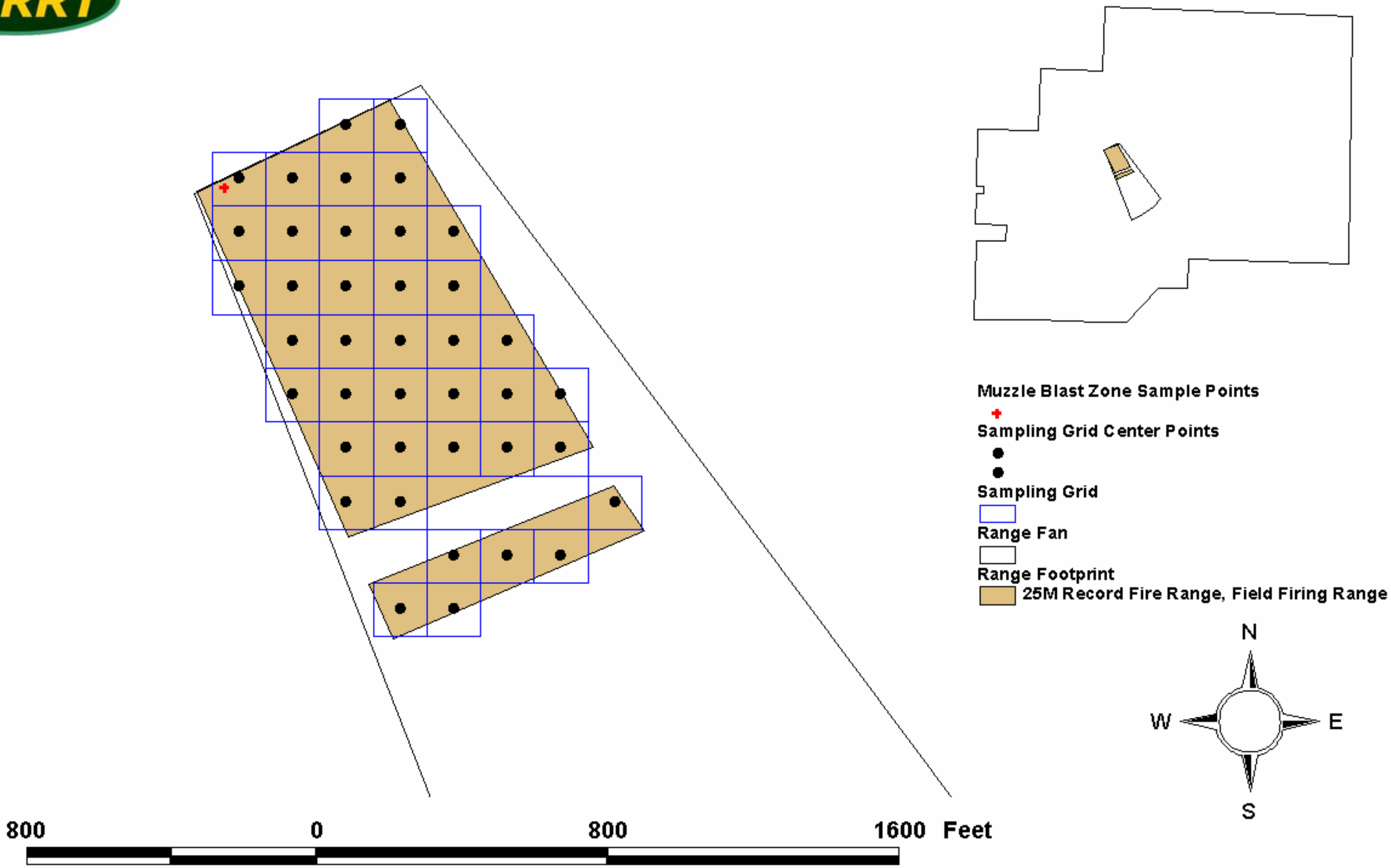

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Figure 20
Locations of Background Samples

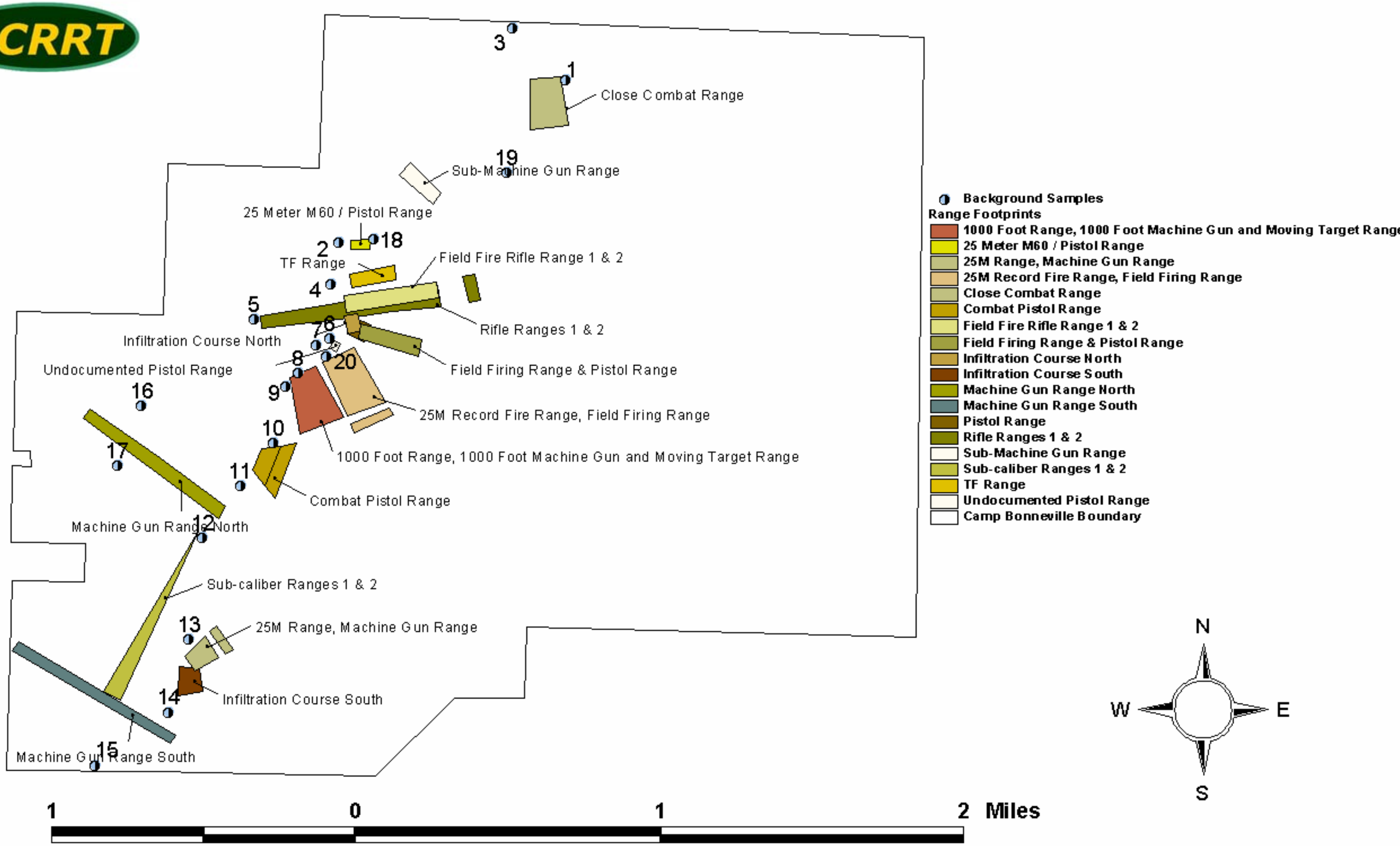

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Figure 21
Rifle Ranges 1 & 2
Areas to be Removed

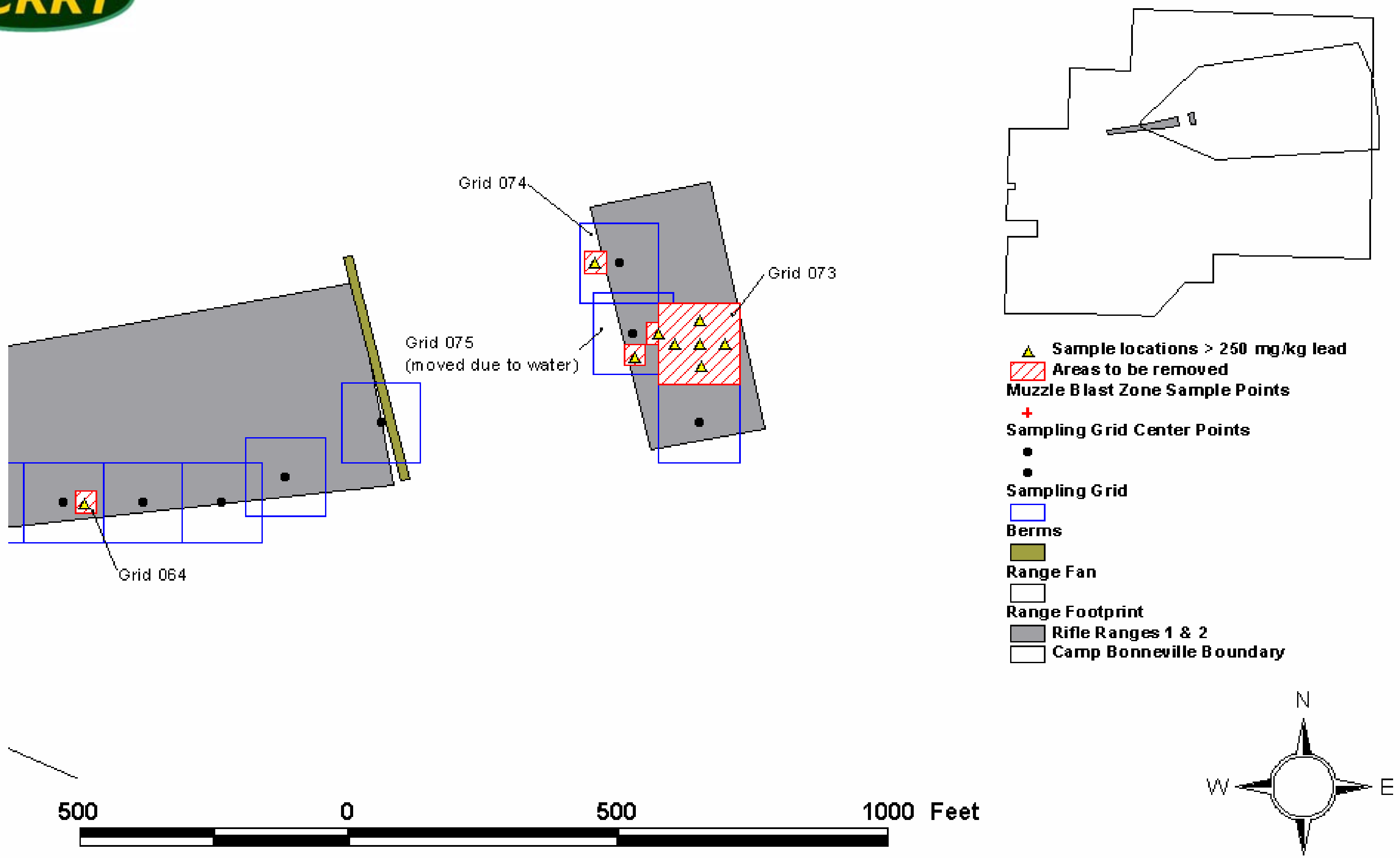

Figure 22
Field Fire Rifle Range 1 & 2
Areas to be Removed

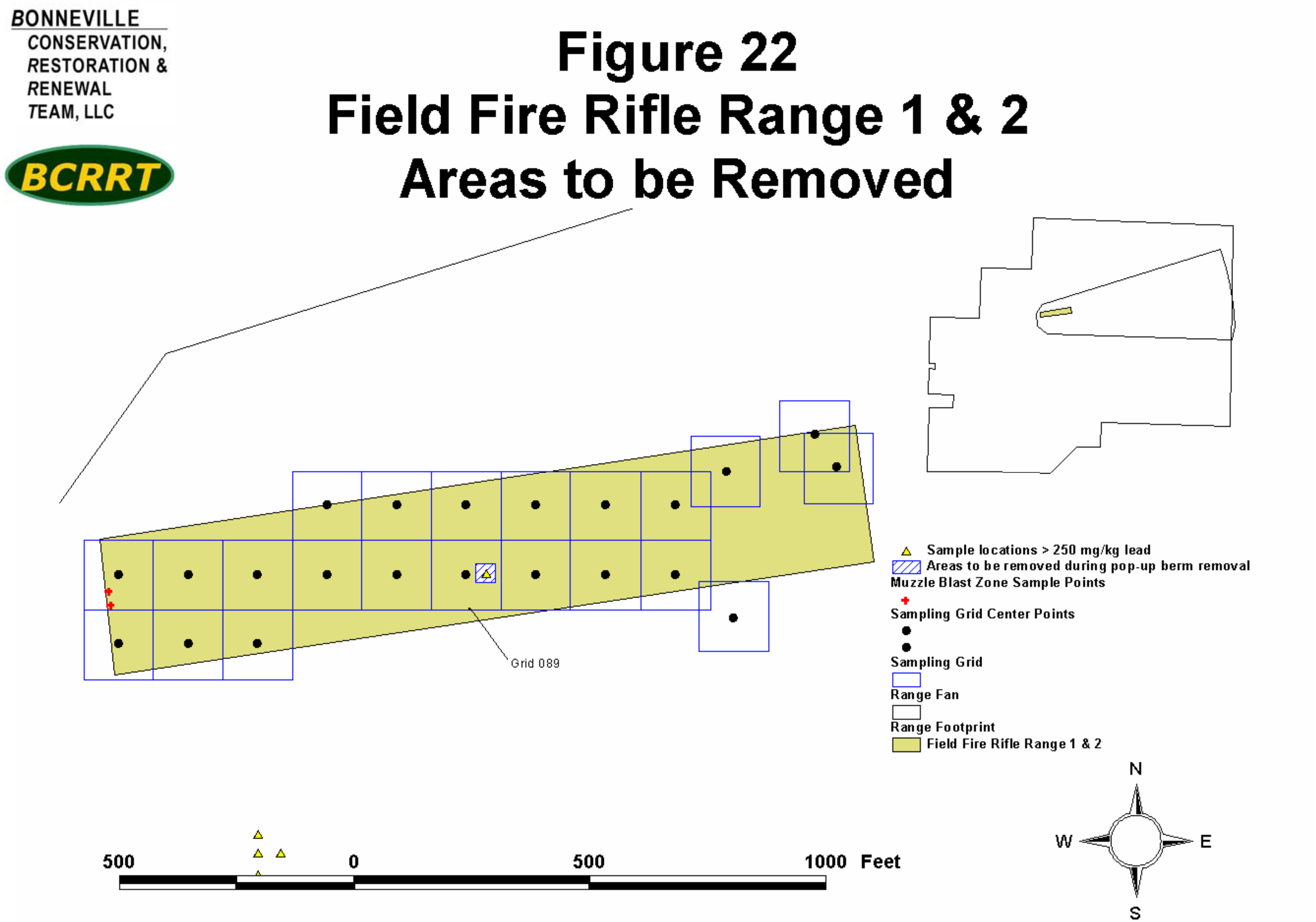

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Figure 23
Field Firing Ranges & Pistol Range
Areas to be Removed

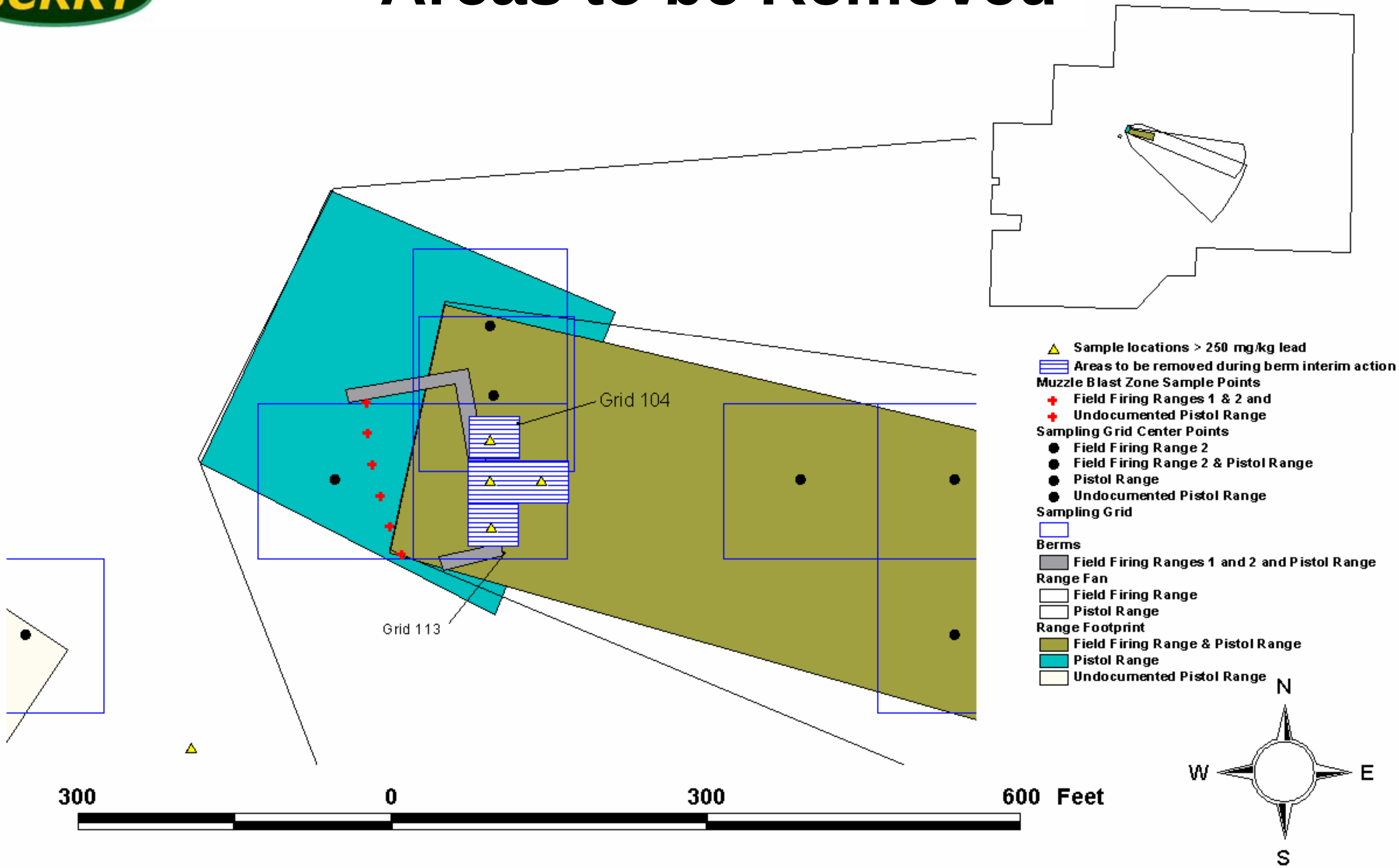

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Figure 24
1000-ft Range, 1000-ft Machine Gun and Moving Target Range Areas to be Removed

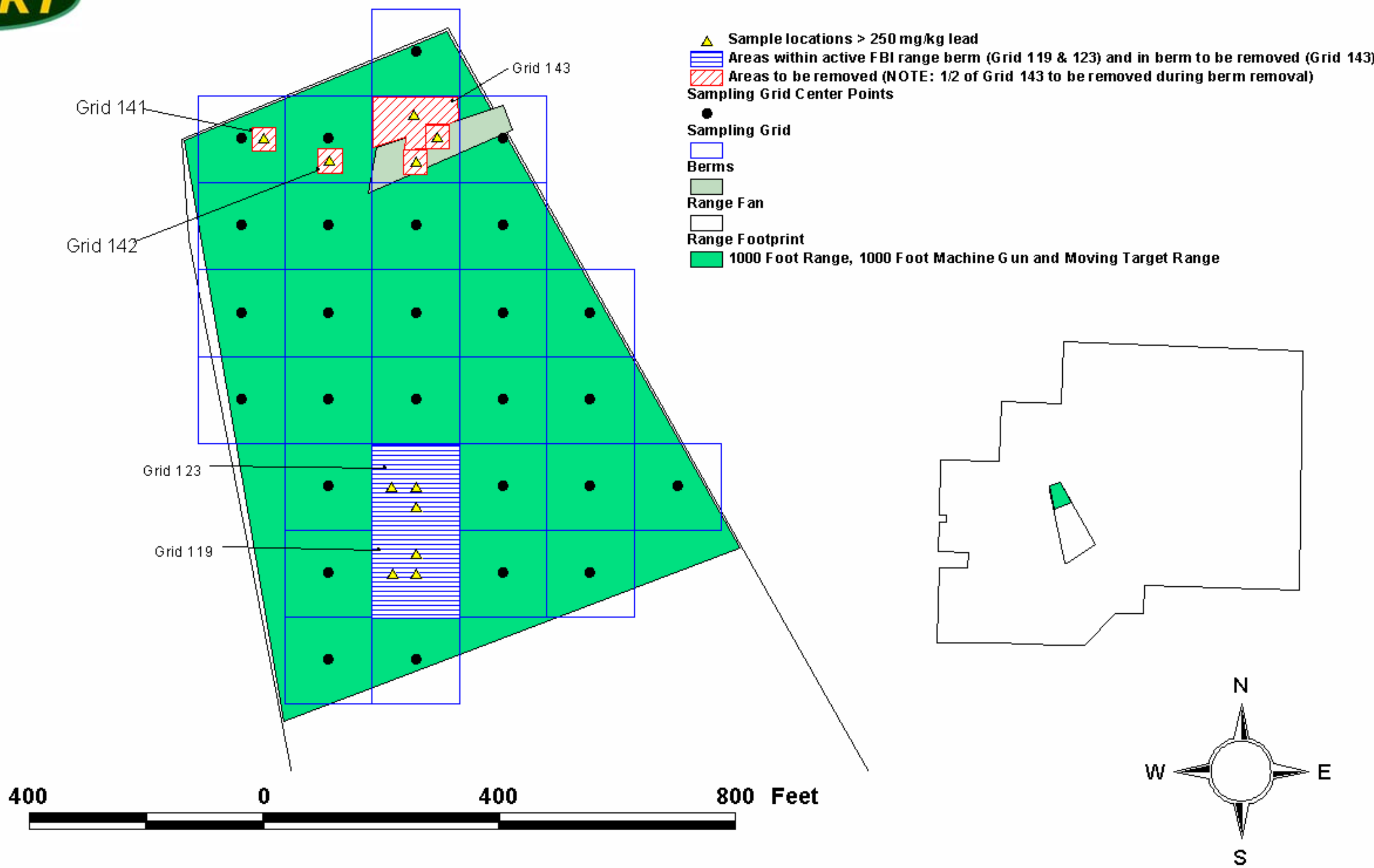

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Figure 25
Combat Pistol Range
Areas to be Removed

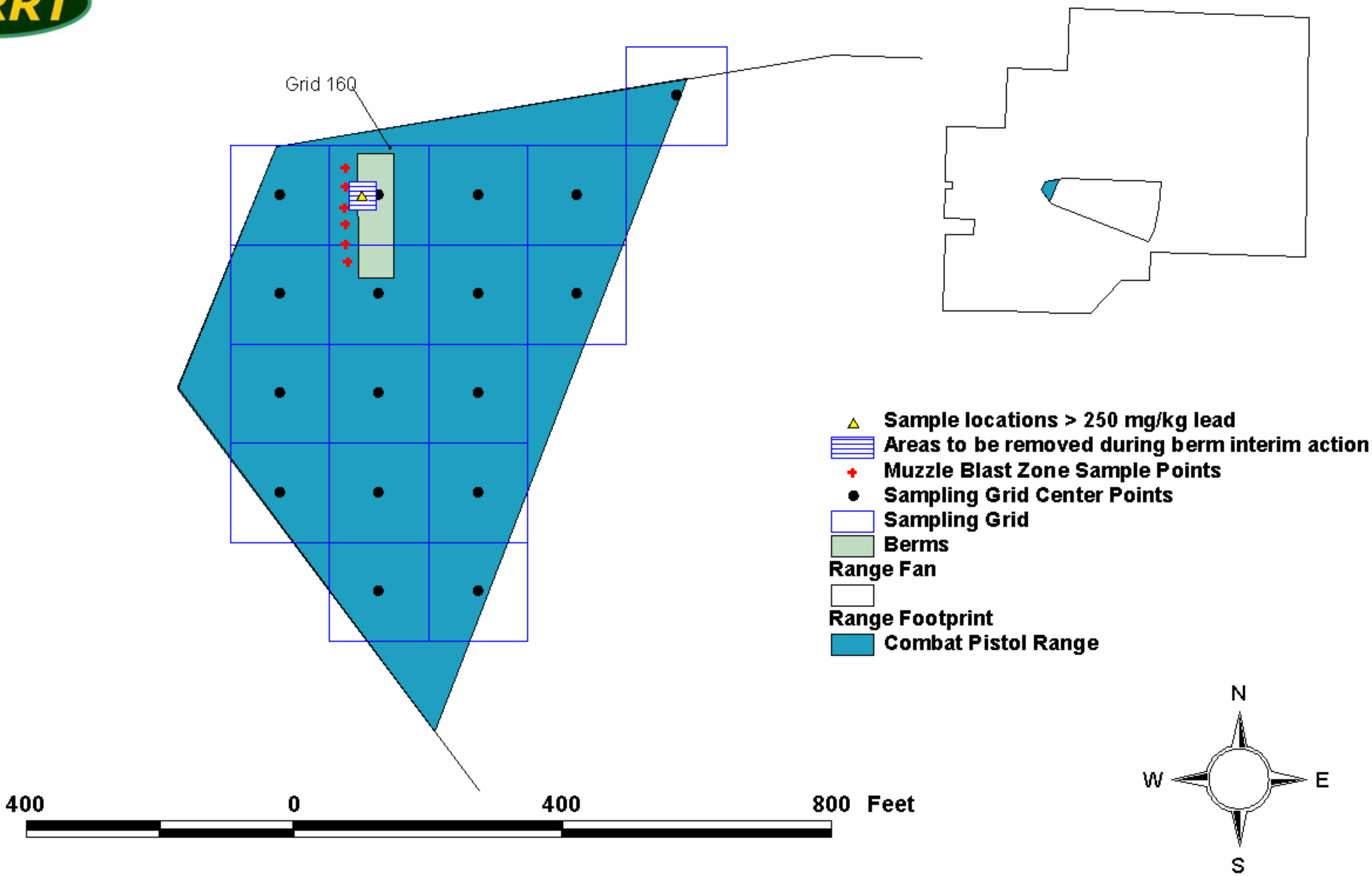

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Figure 26
Machine Gun Range

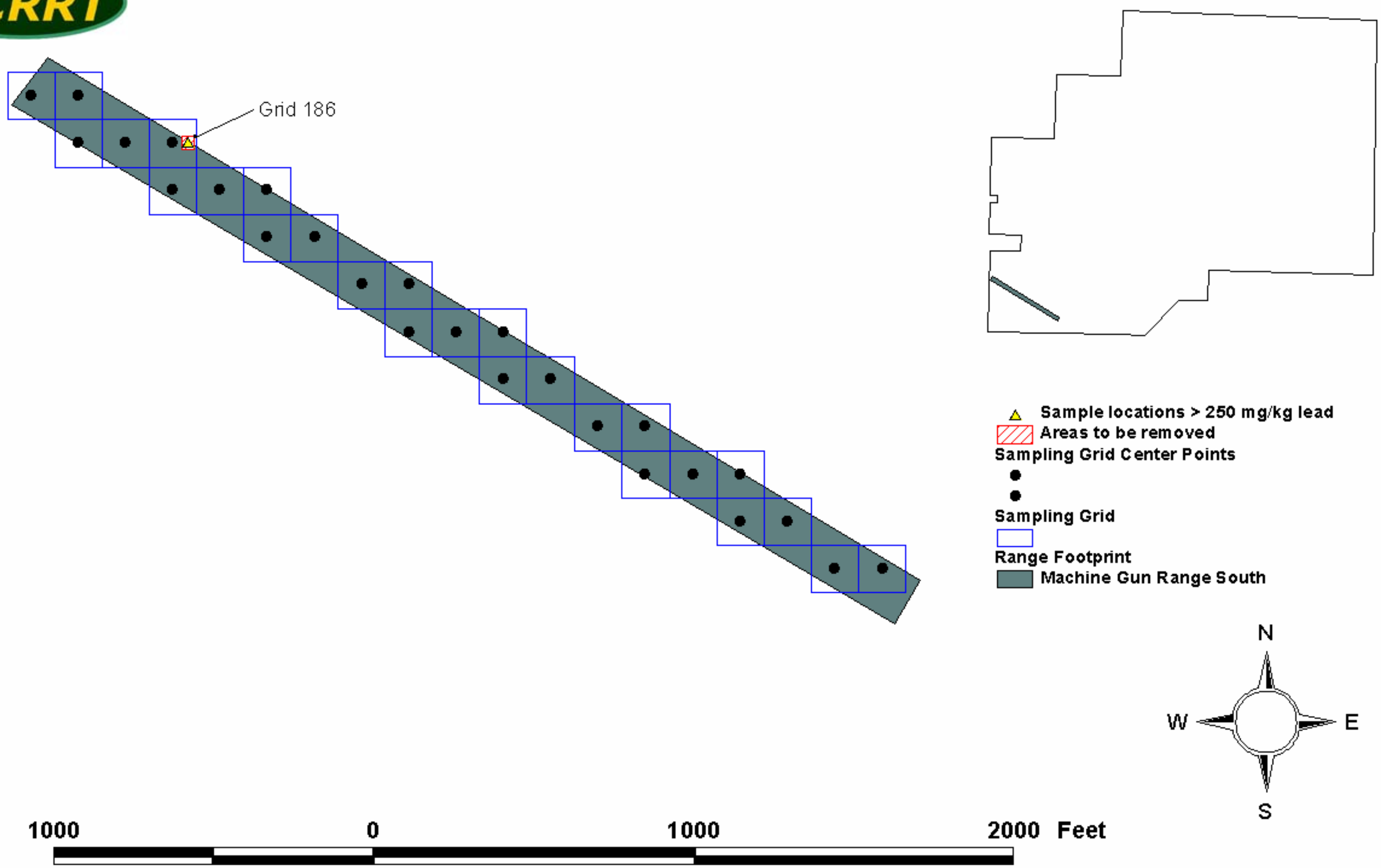

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Figure 27
25 Meter and Machine Gun Range
Areas to be Removed

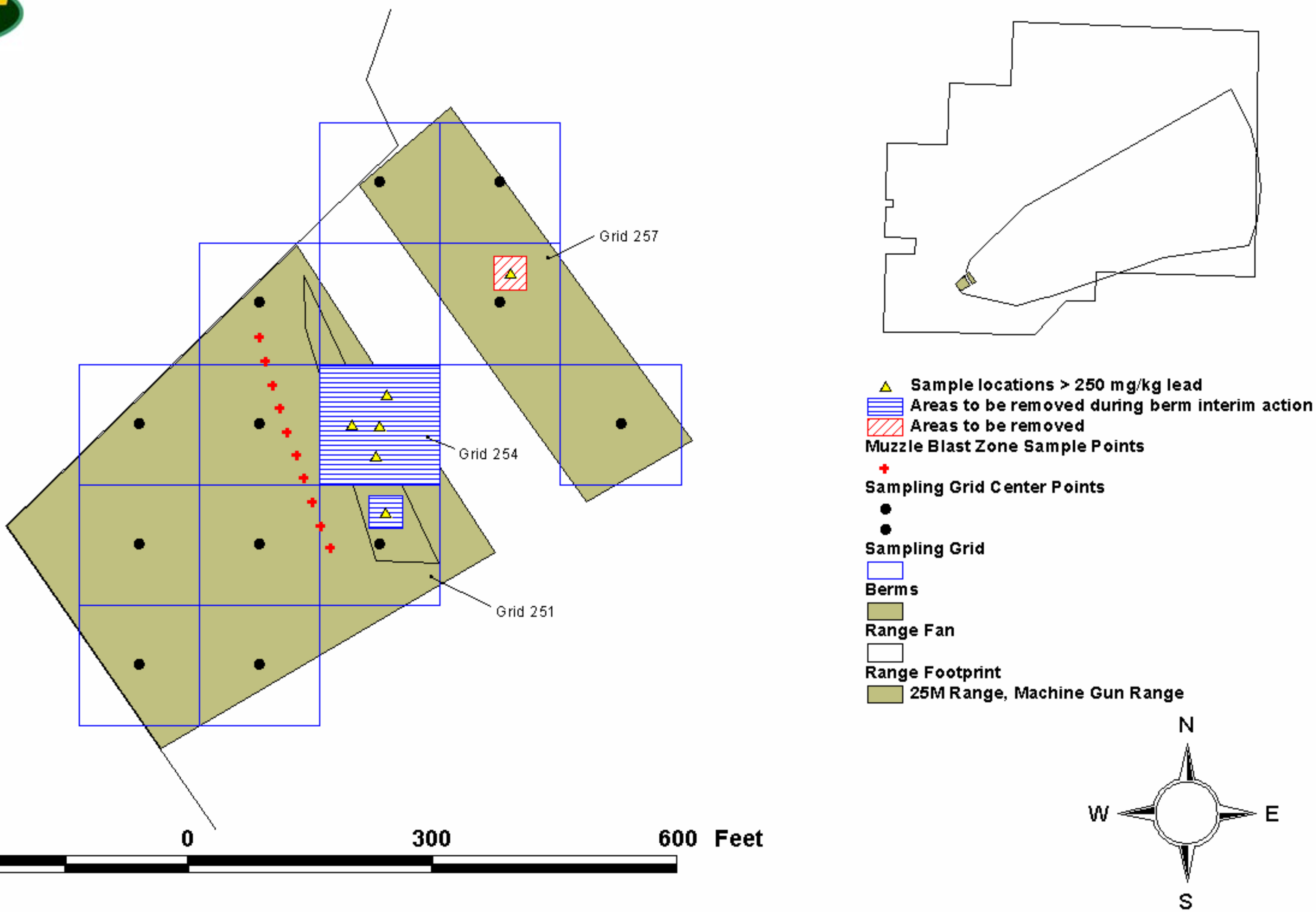

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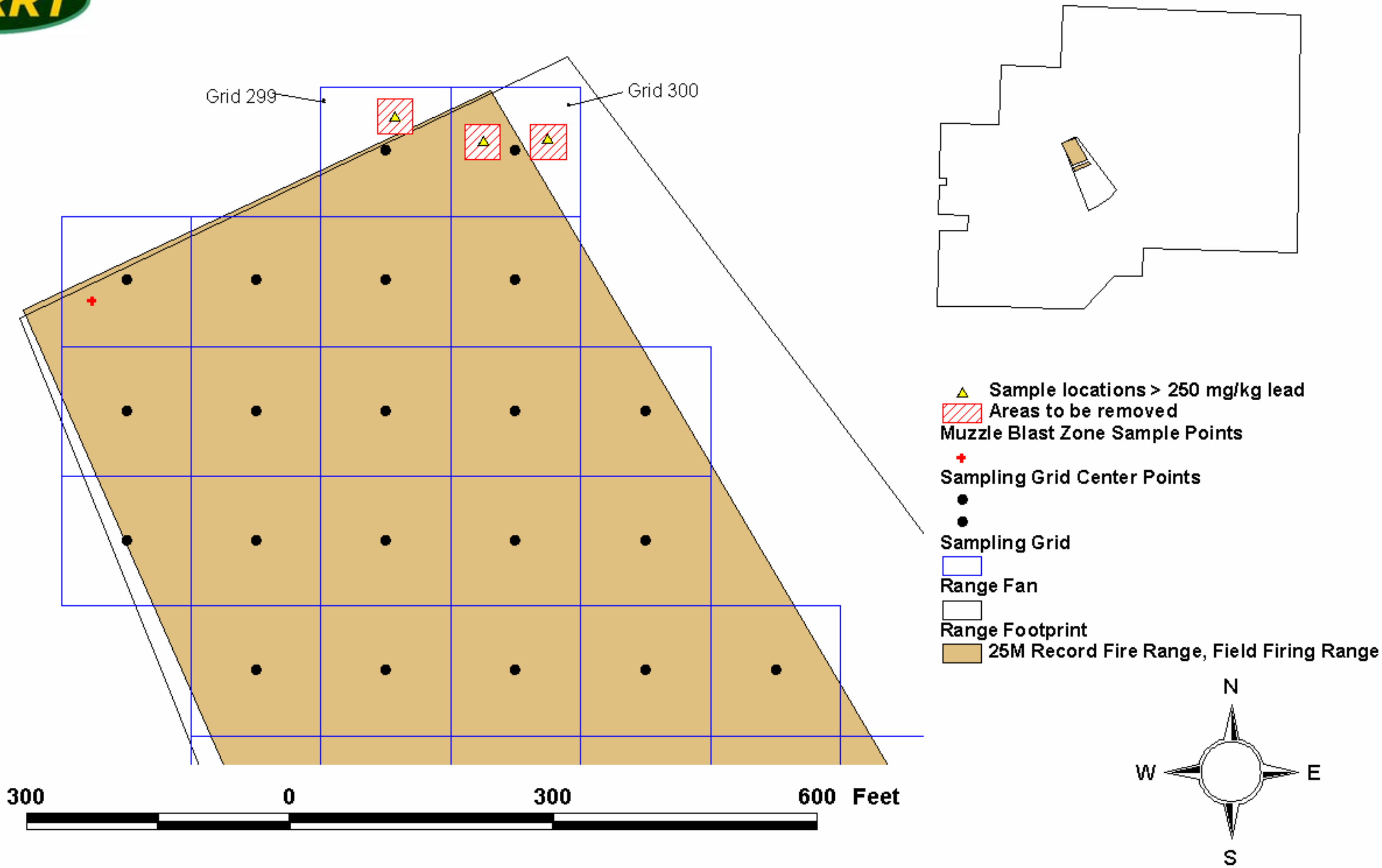
Figure 28
25M Record Fire Field Range, Field Firing Range Areas to be Removed



APPENDIX A
SITE INVESTIGATION REPORT

DRAFT FINAL
Site Investigation Report

Small Arms Ranges
and
Demolition Areas 2 and 3

Camp Bonneville
Vancouver, Washington

AEM Project No. 1160-01

September 25, 2003

Prepared For:

U.S. ARMY ENGINEERING DISTRICT NORFOLK
CENAO-SS-C
803 Front Street
Norfolk, Virginia 23510-1096

Prepared By:

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2580 Northeast Expressway • Atlanta, Georgia 30345
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LIST OF ACRONYMS

AEM	Atlanta Environmental Management, Inc.
bgs	Below Ground Surface
BMV	Benchmark Value
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	Chain of Custody
DA	Demolition Area
DQO	Data Quality Objective
Ecology	Washington State Department of Ecology
FBI	Federal Bureau of Investigation
GPS	Global Positioning System
IDW	Investigation-Derived Waste
mg/kg	Milligrams per Kilogram
µg/L	Micrograms per Liter
MTCA	Model Toxics Control Act
NGVD	National Geodetic Vertical Datum
NS	Not Sampled
PDA	Personal Digital Assistant
PETN	Pentaerythritol Tetranitrate
PRG	Preliminary Remediation Goals
Pt	Troutdale Formation
Qa	Quaternary Flood Plain
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
Qls	Quaternary Landslide Deposit
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SI	Site Investigation
SSHP	Site Safety and Health Plan
Tv	Tertiary Volcanic Bedrock
U.S. EPA	United States Environmental Protection Agency
UST	Underground Storage Tank
UXO	Unexploded Ordnance

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APPENDIX

SECTION 1.0
INTRODUCTION

1.1 PURPOSE OF THE SITE INVESTIGATION

The Site Investigation (SI) conducted by Atlanta Environmental Management, Inc. (AEM) at Camp Bonneville in Vancouver, Washington, is part of the U.S. Army's ongoing Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) investigation of lead-contaminated ranges and Demolition Areas (DA) 2 and 3 at Camp Bonneville. This investigation is being conducted under a Washington State Department of Ecology Enforcement Order and in accordance with the Model Toxics Control Act (MTCA). The SI was conducted under Contract/Purchase Order GS-10F-0135M, Delivery Order No. DACA65-03-F-0002 titled "Site Investigation for Small Arms Ranges, Demolition Areas 2 and 3."

Variable concentrations of lead are known to exist at Camp Bonneville within the top 0 to 6 inches of soil as residue from the firing of small arms. Because of the low mobility of lead in soil, the majority of the lead residue is expected to have remained near the surface of the soil. Considering the expected future use of the installation for recreational activities, it has been determined that the major risk posed by any metal residues arises from direct contact and ingestion of the top 0 to 6 inches of soil.

The concentrations of explosive residues in the soil are expected to vary extensively throughout the SI area, but they are most likely to be found (if detectable) in muzzle blast areas, a result of barrel emissions during live fire of small arms. Explosive residues have a greater mobility in soils than lead, and some portion of the explosive residue may have migrated into the deeper soil horizons, potentially impacting groundwater. Sampling the top 0 to 6 inches of soil for explosive residue will indicate possible explosive residue within the soil column at that sample site.

Perchlorate is used in propellants and was detected in the monitoring wells at Demolition Area 1. Therefore, there is a potential for detectable concentrations of perchlorate in soil at DA 2 and DA 3. The source of the perchlorate is assumed to be residue from ammunition disposal. Perchlorate has a mobility in soils similar to that of explosive residues, and some portion of the perchlorate residue may have migrated into the deeper soil horizons, potentially impacting groundwater. Sampling of the top 0–6 inches of soil and of soil at depths of approximately 2.5 and 5 feet at DA 2, and the top 0–6 inches of soil and soil at a depth of approximately 2.5 feet at DA 3, should indicate possible perchlorate residue within the soil column.

1.2 SCOPE OF THE SITE INVESTIGATION

The scope of the SI was designed to meet the following objectives:

- Determine the concentration of lead residues in the top 0–6 inches of soil at 307 one-half acre grids within the firing ranges.

- Determine the background concentrations of lead in the top 0–6 inches of soil at 20 undisturbed/unused locations within Camp Bonneville.
- Determine the concentrations of explosive residues, including picric acid and pentaerythritol tetranitrate (PETN), in soil in the muzzle blast area of the firing ranges where the firing location is known. (The term "explosive residues" refers to the EPA Method 8330 compound list, modified to include picric acid and PETN. This group of constituents is hereinafter referred to as "explosive residues.")
- Determine the concentrations of explosive residues, perchlorate residues, and metals in soil samples from Demolition Areas 2 and 3. (When used in this report, "metals" refers to nine Priority Pollutant metals analyzed by EPA Method 6010: antimony, arsenic, barium, cadmium, chromium, copper, lead, nickel, and zinc.)

Results of the SI samples will be compared to the benchmark values in the Washington State Department of Ecology (Ecology) MTCA and to U.S. EPA Region 9 Preliminary Remediation Goals (PRG). While not part of the SI scope, these comparisons will be used to identify areas that exceed the benchmark and PRGs and quantify areas to be included in a future cleanup action, if required.

The scope of the SI did not include sampling from target areas/impact zones, fire lines, and backstops, as well as areas where shortfalls have accumulated. These excluded areas of firing ranges will be addressed under removal actions that will include separate confirmational sampling. Removal actions for excluded areas will be addressed in project planning documents separate from those developed for the SI reported herein.

1.3 PROJECT PLANNING DOCUMENTS

Implementation of the SI was governed by the following project planning documents:

- Work Plan for Soil Sampling in Firing Ranges and Demolition Areas 2 and 3
- Sampling and Analysis Plan – Soil
- Quality Assurance Project Plan
- Site Safety and Health Plan
- Data Management Plan
- Waste Management and Minimization Plan

The SI was started after the project planning documents were approved by Ecology.

The Site Safety and Health Plan (SSHP) included specific procedures for avoidance of unexploded ordnance and escort of SI sampling crews in areas where UXO may be present. To meet requirements of the regulations at 29 CFR 1910.120d, the SSHP included the following site control measures for work zones where UXO may be present:

- A specific work area will be established and marked within each firing range sampling grid block. Work areas will extend for a distance of no less than 50 feet from the center grab sample location of each grid located using global positioning system (GPS) measurement of longitude and latitude. The grab sample location located 40 feet north, south, east, and west of the central location will be within the work area. The UXO Specialist will check for anomalies before sampling crews are allowed to enter a work area and will direct sampling crews away from possible anomalies.
- Paths between grid center locations will be marked after being traversed by the UXO Specialist. The centerline of each path will be marked and paths will extend for approximately 5 feet on each side of the centerline (i.e., total path width of approximately 10 feet).
- Movement into and out of small arms ranges will be done with escort by the UXO Specialist, or on marked paths. Movement within a range without escort by the UXO Specialist will be limited to the marked work areas and paths. There will be no movement outside marked work areas or paths, or without escort, even if such movement is the shortest distance to the intended location.
- At DA 2 and DA 3 the UXO Specialist will check for anomalies within and approximately 10 feet beyond the periphery of each demolition area before sampling crews are allowed to enter. The UXO Specialist will direct sampling crews away from possible anomalies.

1.4 PROJECT TIMELINE

The SI was implemented on the timeline summarized in Table 1-1.

Table 1-1
Project Milestones and Schedule

Task		Start Date	Duration (Weeks)	Completion Date
Number	Description			
1	Prepare Draft Work Plan	05 Dec 02	3	26 Dec 02
2	Regulatory Review	27 Dec 02	7	13 Feb 03
3	Finalize Work Plan	14 Feb 03	1	14 Feb 03
4	Start Soil Sampling	24 Feb 03	4	21 Mar 03
4.1	Laboratory Analyses	24 Feb 03	6	04 Apr 03
4.2	Results Evaluation	24 Feb 03	6	04 Apr 03
5.1	Draft SI Report	21 Mar 03	4	18 Apr 03
5.2	Army Review	28 Apr 03	3	16 May 03
5.3	Regulatory Review	19 May 03	6	27 Jun 03
5.4	Final SI Report	30 Jun 03	2	11 Jul 03

Tasks in the timeline are those included in Award Documents for Contract/Purchase Order GS-10F-0135M, Delivery Order No. DACA65-03-F-0002. Table 1-1 is taken from Table 8-1 in the approved Work Plan and includes anticipated dates for completion of tasks beyond the draft SI report.

1.5 SITE INVESTIGATION REPORT CONTENTS AND PRESENTATION

Results of the SI are presented in the following sections of this report:

- Section 2.0 presents information on the history and setting of Camp Bonneville.
- Section 3.0 describes the methods used to collect and manage samples during the SI. This section of the report includes a table summarizing sample locations that had to be modified because of the presence of immovable objects and standing or running water.
- Section 4.0 describes procedures for analyses of SI samples and for data management and summarizes quality control and quality assurance (QA/QC) procedures used during the SI. Section 4.0 presents tables with results of analyses of duplicate samples collected during implementation of the QA/QC procedures.
- Section 5.0 compares sampling results from the SI to MTCA and PRG benchmark values. This section of the report includes tables summarizing sample concentrations greater than the benchmark values, along with figures illustrating the locations of those samples with concentrations greater than the benchmark values.
- Appendix A presents tables with results from all samples collected during the SI (except duplicate samples, which are tabulated in Section 4.0).
- Appendix B presents figures illustrating results from all samples collected during the SI (except duplicate samples).
- Appendix C presents summary tables of sample locations, latitude and longitude coordinates of sampling grid centers, sample numbers, and corresponding photograph numbers. In the summary tables, sample numbers are hot-linked to the corresponding photograph. Appendix C is included in the report on Compact Disc in electronic format.
- Appendix D presents the sample photographs hot-linked from the summary tables in Appendix C. Appendix D is included in the report on Compact Disc in electronic format.
- Appendix E presents laboratory data reports for the SI samples. Appendix E is included in the report on Compact Disc in electronic format.
- Appendix F presents manifests for disposal of investigation derived waste (IDW).

Because of the large number of samples collected during the SI, and the corresponding large numbers of summary tables, photographs, and laboratory data reports, Appendices C, D, and E are in electronic format only.

SECTION 2.0
SITE HISTORY AND SETTING

2.1 HISTORY OF CAMP BONNEVILLE

Camp Bonneville comprises approximately 3,840 acres and is located in southwestern Washington, approximately 10 miles northeast of Vancouver, Washington (Figure 2-1). The Army used Camp Bonneville for live fire of small arms, assault weapons, artillery, and field and air defense artillery between 1910 and 1995. Since 1947, Camp Bonneville has also provided training for a variety of military and nonmilitary units from the National Guard, Reserves, U.S. Air Force, and federal, state, and local law enforcement agencies. In the early 1950s the Defense Department arranged to lease an additional 840 acres from the State of Washington Department of Natural Resources (DNR) to expand training possibilities of the post. The facility has been used for weekend and summer training by the U.S. Army Reserve units in southern Washington and northern Oregon and is currently a sub-installation of Fort Lewis.

In July of 1995, Camp Bonneville was selected for closure under the 1995 Base Realignment and Closure (BRAC) process. The majority of Camp Bonneville will be transferred to Clark County under a public benefit conveyance for education, law enforcement, and parks. The land currently leased from the Washington DNR will be returned to the State, or the lease will be renewed, or the property will be purchased and transferred to Clark County.

2.2 SITE SETTING

2.2.1 Regional Geology and Physiography

Camp Bonneville is situated on the margin of the western foothills of the southern Cascades in the transition zone between the Puget Trough and the Willamette Trough Provinces. The geology of this area generally consists of Eocene and Miocene volcanic and sedimentary rock types overlain by unconsolidated clays, silts, sands, and gravels of the Troutdale Formation (Phillips, 1987).

The area surrounding Camp Bonneville is sparsely populated with scattered residences and is used primarily for agriculture and livestock grazing. The nearest town is Proebstel, an unincorporated community about 2.5 miles to the southwest of the western entrance to the camp. The two cantonments, Camp Killpack and Camp Bonneville, are located on the valley floor. The remainder of Camp Bonneville consists of moderately steep, heavily vegetated slopes that have been used primarily as firing ranges. The valley floor is a relatively narrow floodplain, which ranges from an elevation of about 290 feet National Geodetic Vertical Datum (NGVD) on the western end of Camp Bonneville to about 360 feet NGVD on the east (Figure 2-2). The adjoining slopes rise moderately steeply to elevations between 1,000 and 1,500 feet NGVD along ridge tops within the property boundaries. The entire installation is heavily vegetated.

2.2.2 Surface Water Hydrology

The principal surface water feature in the vicinity of the investigation area is Lacamas Creek, which flows southward from the confluence of two branch streams in the north central part of Camp Bonneville, exiting the installation at its southwest corner. From the southwestern property boundary, Lacamas Creek flows southwestward to Proebstel, where it turns toward the southeast and continues to its confluence with the Columbia River at the town of Camas. Numerous minor tributaries that drain adjacent uplands flow into Lacamas Creek. Buck Creek and David Creek, the largest of these streams, drain the southeastern hills of Camp Bonneville.

Two artificial impoundments of Lacamas Creek, with a total surface area of less than 4,600 square feet, have been created to support a trout sports fishery. Recently, the impoundments have been drained.

2.2.3 Site Geology and Soils

Camp Bonneville is situated along the structural and physiographic boundary between the western flank of the southern Cascade Mountains and the Portland-Vancouver Basin. The geology of the Camp Bonneville vicinity is known primarily from geologic mapping by Mundorff (1964) and Phillips (1987), a limited number of well logs available from the general area, and a Multi-Sites Investigation conducted by Shannon & Wilson (1999a).

The geology at Camp Bonneville can be divided into three general areas that correspond approximately to topographic divisions. The area west of Lacamas Creek is composed of a series of predominantly gravel and semi-consolidated conglomerate layers with scattered lenses and stringers of sand (Upper Troutdale Formation).

Underlying the Troutdale Formation and comprising the area to the north and east of Lacamas Creek are predominantly basalt flows and flow breccia, with some pyroclastic and andesitic rocks that are folded and faulted. The bottomland along Lacamas Creek is composed of unconsolidated silt, sand, and gravel valley fill, with some clay. Because of the thick soil and dense vegetation, faults have not been identified within Camp Bonneville (Environmental Science and Engineering, Inc. [ESE], 1983).

The Camp Bonneville soils are mainly low-permeability clays, which result in considerable runoff after storms and occasional minor flooding of Lacamas Creek. Upland soils have mainly developed from basalt and are generally gravelly or stony and fairly shallow. Bottomland soils along Lacamas Creek tend to be clayey (Geo Recon International, 1981). Shannon & Wilson (1999a) described the four distinctive stratigraphic units that underlie Camp Bonneville:

- Quaternary floodplain and stream channel alluvium and lacustrine deposits, which mantle the Lacamas Creek valley floor (Qa).
- A Quaternary landslide deposit (Qls) of surface soils and bedrock displaced from the steep slope along David Creek.

- A thick sequence of Quaternary to Pliocene-age gravel, fine-grained sand, and cobbly and bouldery sand known as the Troutdale Formation (Pt), which underlies areas to the west of the Bonneville cantonment.
- Oligocene volcanic bedrock (Tv), which is exposed at the surface in the eastern part of Camp Bonneville.

Quaternary alluvium deposits constitute the shallow surface soils of the Lacamas Creek valley floor, which is composed of stream channel, floodplain, and alluvial fan sediments. These deposits are expected to consist of a thin layer of clay and silt, underlain by layers of sand/silt and clay. During drilling and excavation activities associated with the removal of an underground storage tank (UST) in Camp Killpack (Hart Crowser, 1996), at least 25 feet of silty clay was encountered and interpreted to be older alluvium. Borings from the Multi-Sites Investigation (Shannon & Wilson, 1999a) also encountered alluvial clays and silts overlying a relatively thick, silty clay deposit in the Camp Bonneville cantonment. These clayey soils probably originated as water-borne sediments that were deposited on the valley floor in Quaternary time as a result of catastrophic flooding along the Columbia River (Shannon & Wilson, 1999a).

The Troutdale Formation, which underlies the westernmost portion of the camp, ranges from a poorly consolidated sand and gravel to a well indurated conglomerate in its upper part. Based on regional boring logs, the Upper Troutdale Formation locally is about 150 feet thick and consists of cemented sand, gravel, sandy clay, and boulders. It is underlain by up to 150 feet of the Lower Troutdale Formation, which contains considerably more clay interspersed with sandy and gravelly layers. There is considerable variation in the lithology and thickness of the Troutdale Formation. In general, the formation thins eastward against the underlying bedrock, and the lower part of the formation reportedly is typically coarser-grained toward the east (Mundorff, 1964).

The bedrock that underlies the alluvial deposits and Troutdale Formation is exposed at the surface in the eastern part of Camp Bonneville. This bedrock consists of Oligocene-age andesite and basaltic andesite flows, minor flow breccias, tuffs, and volcaniclastic sandstones. According to the boring logs from the Multi-Sites Investigation (Shannon & Wilson, 1999a), the uppermost bedrock is severely weathered. This weathered bedrock tends to form surface soils that contain gravel of basalt lithology. During drilling for the Multi-Sites Investigation, bedrock was encountered in 10 soil borings at depths ranging from approximately 6 to 37 feet below ground surface (bgs).

2.2.4 Hydrogeology

Limited information is available about the hydrogeology of Camp Bonneville. Most prior work throughout the Clark County area has focused on the Troutdale Formation (as described in Mundorff, 1964). Camp Bonneville resides over the eastern edge of the Troutdale Formation where it is pinched out by the underlying bedrock. There are two drinking water wells at Camp Bonneville: a 385-foot-deep well at the Camp Bonneville cantonment and a 193-foot-deep well at the Camp Killpack cantonment (ESE, 1993). The latter well is apparently different from the 516-foot-deep well at the Camp Killpack cantonment described by Mundorff (1964). In addition, a well was drilled at the Federal Bureau of Investigation (FBI) range during 1998, extending to a depth of 105 feet bgs (Shannon & Wilson, 1999b). Several groundwater monitoring wells associated with the sewage lagoon are located east of the Camp Bonneville cantonment and, to date, no groundwater samples have been collected from these wells. Based on regional information from Mundorff (1964) and the reported depths of the wells at the camp, water supply wells in the area generally extend into the Troutdale Formation or underlying bedrock. Most of the nearby wells apparently obtain groundwater from depths of 150 to as much as 500 feet bgs.

The water table is typically within a few feet of the surface in areas underlain by alluvium and appears to fluctuate seasonally by several feet. A rising water table occurs in the early fall through spring during the rainy season, and a declining water table occurs throughout the summer. The localized groundwater flow generally follows local topography toward tributaries and creeks.

Generally, groundwater flows southwest from the uplands and somewhat parallel to Lacamas Creek. The elevation of the water table in the alluvial valley areas of Camp Bonneville is expected to be fairly shallow (in the range of 5–20 feet bgs) based on the presence of shallow bedrock, multiple creeks, tributaries, and boggy areas.

Monitoring wells were installed as part of the investigation of Landfill 4, an upland area of Camp Bonneville (Shannon & Wilson, 1999b). The depths to water in these wells ranged from 10.4 feet bgs to 18.8 feet bgs. The limited groundwater elevation data suggested a groundwater flow direction toward the creek, which is consistent with the surface topography.

SECTION 3.0
SITE INVESTIGATION METHODS

3.1 SAMPLE LOCATIONS

3.1.1 Small Arms Ranges

Soil samples were collected from the small arms ranges at the locations indicated by latitude and longitude coordinates in Appendix A of the approved Sampling and Analysis Plan – Soil (SAP). Latitude and longitude were determined using a Garmin® GPS V Personal Navigator™ satellite-based global positioning system (GPS). In areas without excessive tree cover where adequate satellite reception could be achieved, this GPS unit was capable of identifying locations within the precision/detection limit of 23 to 34 feet given in Table 3-2 of the SAP. The precision/detection limit of the GPS unit was checked before the start of each day's fieldwork by measuring latitude and longitude at a U.S. Geological Survey (USGS) benchmark with known latitude and longitude. The USGS benchmark used for daily checks of the GPS precision/detection limit is designated RD2935, Airport (the airport is Evergreen Field in Vancouver), in Clark County, Washington, on the 1990 Mount Tabor USGS quadrangle map. Each daily measurement was within the precision/detection limit for the SI.

After specific locations were determined using GPS, the center point of each grid was marked using a metal "pin flag." The field team determined sample locations by measuring the distance from the pin flag. The center pin flag was left in place; however, these are considered temporary markers.

Locations of the small arms ranges at Camp Bonneville are shown on Figure 3-1. Soil samples were collected from firing ranges within 307 half-acre grids. The number of half-acre grids at each range is summarized in Table 3-1.

Table 3-1
Small Arms Range Sampling Grids

Small Arms Range Designation	Number of Sampling Grids
Close Combat Range	24
25 Meter M60 Range/Pistol Range	4
Sub Machine Gun Range	7
TF Range	8
Rifle Ranges 1 & 2	32
Field Fire Rifle Ranges 1 & 2	22
Infiltration Course North	4
Field Firing Ranges 1 & 2 and Pistol Range	14
Undocumented Pistol Range	1
1,000 Foot Range, 1,000 Foot Machine Gun and Moving Target Range	30
Combat Pistol Range	17
Machine Gun Range – South	26
Machine Gun Range – North	33
M31 Sub-Caliber Ranges 1 & 2	25
25 Meter and Machine Gun Range	13
Infiltration Course South	7
25M Record Fire Field Range, Field Firing Range	40
Total Half-Acre Sampling Grids	**307**

Five (5) soil samples were collected from each grid: one (1) from the center of the grid, identified by latitude and longitude coordinates measured using the GPS unit described in the preceding section of this report, and one (1) each from locations approximately 40 feet north (magnetic), south, east, and west of the grid center. The array of five grab samples within each grid had approximate dimensions of 80 feet by 80 feet, covering an area of approximately 6,400 square feet (approximately 29 percent of the total area of a one-half-acre grid).

Characterization of each half-acre plot in the firing ranges using five grab samples taken from the top 0–6 inches of soil is consistent with the EPA sampling plan developed for residential areas of lead-contaminated sites in northern Idaho. This sampling scheme also provides data for statistical representation. It is necessary to take10 samples from any target area in order to calculate a 95 percent UCL. With five samples from each half-acre plot, there will be 10 samples per acre, sufficient for calculation of the 95 percent UCL on a per acre basis.

Every effort was made to locate grid centers and outlier sample locations as described in the preceding paragraph. However, some of the grid centers and outlier locations were obstructed by dense vegetation, immovable objects such as trees and boulders, and moving or standing water. Where locations of grid centers had to be modified, the latitude and longitude of the modified location was measured with the GPS unit. Where locations of outlier samples had to be modified, the compass direction and distance from the planned location was noted. A summary of modified sample locations is presented in Table 3-2. Latitude and longitude coordinates for modified grid locations are included in the summary tables of sample locations presented in Appendix C of this report and are illustrated in the figures in Appendix B and Section 5.0.

Table 3-2
Modified Sample Locations

Range Designation	Grid No.	Grid Sample	Location Modification Distance[1]	Location Modification Reason
TF Range	028	East	10 ft. North	Location in stream
	036	South	40 ft. West	Location in stream
		East	40 ft. North	Location in stream
		West	5 ft. North	Move location from gravel road
	037	South	40 ft. South	Location in stream
	038	West	40 ft. North	Location in stream
	043	South	15 ft. North	Location in stream
		West	15 ft. North	Location in standing water
Rifle Ranges 1 & 2	048	Center[2]	10 ft. North	Location in roadway
	051	South	5 ft. East	Location in stream
	054	Center	25 ft. North	Location in standing water
		South	30 ft. East	Location in standing water
	055	North	10 ft. North	Location in dense vegetation
	056	Center	10 ft. West	Location in stream
		North	10 ft. North	Location in stream
	057	South	15 ft. West	Move location from gravel road
	058	East	15 ft. South	Moved away from metal benches
	061	West	35 ft. West	Location in stream
	067	South	15 ft. East	Move location from gravel road
	068	North	15 ft. North	Location in stream
	070	Center	120 ft. Southwest	Location in standing water
		North	15 ft. South	Location in standing water
	075	Center	195 ft. Southeast	Location in standing water
Field Fire Rifle Ranges 1 & 2	078	North	10 ft. West	Location in stream
		East	10 ft. South	Location in stream
	093	Center	115 ft. Southwest	Location in standing water
		North	6 ft. South	Location in standing water
		South	9 ft. North	Location in standing water
	095	Center	10 ft. North	Location in stream
	096	Center	80 ft. North	Location in standing water
	097	Center	130 ft. Northeast	Location in standing water
		North	20 ft. South	Location in standing water
		South	12 ft. North	Location in standing water
Field Firing Ranges 1 & 2 and Pistol Range	104	Center	390 ft. Northwest	Location in standing water
	105	North	10 ft. East	Location in standing water
		West	20 ft. West	Location in standing water

Range Designation	Grid No.	Grid Sample	Location Modification Distance[1]	Location Modification Reason
Field Firing Ranges 1 & 2 and Pistol Range (continued)	109	Center	440 ft. Southeast	Location in standing water
	110	South	20 ft. North	Location in standing water
	113	East	10 ft. east	Location in standing water
1,000 Foot Range, 1,000 Foot Machine Gun and Moving Target Range	119	West	10 ft. east	Location beneath concrete pavement
Combat Pistol Range	148	North	10 ft. West	Location in stream
		East	10 ft. West	Location beneath fallen tree
Machine Gun Range – South	170	South	10 ft. South	Location in standing water
		West	15 ft. North	Location in standing water
	174	North	10 ft. South	Location in dense vegetation
		East	10 ft. west	Location in dense vegetation
	177	South	30 ft. North	Location in standing water
	182	South	5 ft. South	Location in standing water
		East	10 ft. East	Location in standing water
Machine Gun Range – North	205	South	27 ft. West	Location in stream
M31 Sub-Caliber Ranges 1 & 2	232	West	5 ft. East	Location in stream
	233	North	15 ft. South	Location in stream
		West	17 ft. East	Location in stream
	236	West	28 ft. East	Location in stream
	237	South	10 ft. East	Location in stream
25 Meter and Machine Gun Range	253	North	8 ft. West	Move location from range shelter
Infiltration Course South	660	MBZ[3]	10 ft. East	Location in standing water
25M Record Fire Field Range, Field Firing Range	271	North	5 ft. West	Location beneath boulders
	272	North	5 ft. South	Location beneath boulders
	290	West	10 ft. North	Location in standing water

Notes

1 Approximate distance and direction (based on magnetic north) from intended sample location (i.e., grid center, or approximately 40 ft. north, south, east, or west of the grid center).

2 Modified grid centers are indicated on figures in Section 5.0 and Appendix B. Outlier sample locations are measured north (magnetic), south, east, and west of the modified grid center.

3 Sample from muzzle blast zone.

At ranges where the firing line could be located, samples were collected along the muzzle blast zones at intervals of approximately 30 feet, per the agreed upon conceptual site model. Muzzle blast zone samples were collected at the ranges summarized in Table 3-3.

Table 3-3
Modified Sample Locations

Small Arms Range Designation	Number of Muzzle Blast Zone Samples
25 Meter M60 Range/Pistol Range	6
TF Range	2
Rifle Ranges 1 & 2	7
Field Fire Rifle Ranges 1 & 2	2
Infiltration Course North	2
Field Firing Ranges 1 & 2 and Pistol Range	6
Undocumented Pistol Range	5
Combat Pistol Range	6
M31 Sub-Caliber Ranges 1 & 2	6
25 Meter and Machine Gun Range	10
Infiltration Course South	14
25M Record Fire Field Range, Field Firing Range	2
Total Muzzle Blast Zone Samples	**68**

3.1.2 Background Locations

Soil samples were collected from 20 background locations using the following criteria:

- Within the Camp Bonneville site boundary.
- Within similar geology/geomorphology as range grid samples.
- Not within small arms range as shown in Work Plan or Sampling and Analysis Plan – Soil.
- Not within small arms range fan as shown on Plate 30 of July 1997 *Final Archives Search Report – Report Plates*.
- Not downslope of range or fan; locate upslope of range or fan if possible.
- Not downrange of firing line. If the firing line is not indicated in the SAP, assume that the firing line was at the low-elevation end of the range and that the direction of fire was toward higher ground surface elevations.
- Not in demolition area.
- Not in artillery impact area (for UXO safety reasons).

Specific locations of background samples are illustrated in Figure 3-1 and summarized in Table 3-4.

Table 3-4
Background Sample Locations

Map Designation	Location Description
1	Up slope from Close Combat Course
2	Up slope from 25 Meter M60/Pistol range
3	Side slope from Close Combat Course
4	Side slope of TF record Fire and behind firing line
5	Side slope from Rifle Range and behind firing line
6	Flat area on east side of creek in vicinity of Rifle Range, Infiltration Course, Field Firing Range, and Undocumented Pistol range
7	Same as S506YMMDDC on west side of creek
8	Flat area on south side of creek behind firing line of 1000 Foot Range, 1000 Foot Machine Gun and Moving Target Range
9	Side slope from 1000 Foot Range, 1000 Foot Machine Gun and Moving Target Range
10	Side slope from Combat Pistol Range
11	Side slope from Machine Gun Range and Combat Pistol Range
12	Side slope of Machine Gun Range, side slope from and behind firing line of Sub-caliber Artillery
13	Side slope from 25M Range, Machine Gun Range and up slope from Sub-caliber Artillery
14	Side slope from Infiltration Course, Machine Gun Range
15	Up slope from Machine Gun Range
16	Up slope from Machine Gun Range
17	Up slope from Machine Gun Range
18	Side slope from Sub-Machine Gun range
19	Side slope from Sub-Machine Gun range
20	Flat area on south side of creek behind firing line of 25M Range, Record Firing Range, Field Firing Range

Latitude and longitude coordinates of the background samples are included in the summary tables of sample locations presented in Appendix C of this report.

3.1.3 Demolition Areas

DA 2 occupies approximately 1 to 1.5 acres. Unlike DA 3, it is not characterized by an identifiable depression or crater. For these reasons, the sampling scheme for DA 2 is different from the scheme for DA 3.

At DA 2, three (3) samples were collected, or were attempted, from locations in the approximate center of DA 2, and from four locations at distances of approximately 100 feet north (magnetic), south, east, and west from the center point. Samples at each location were collected using decontaminated stainless steel hand augers, or were attempted, from successively deeper intervals: from the top 0–6 inches of soil and from depths of approximately 2.5 feet and 5 feet bgs (or at shallower depth if hand digging ceased to be productive). Locations were adjusted to remain within the apparent area of DA 2. Locations of the DA 2 samples are shown on Figure B-30 in Appendix B.

At the center, north, and west locations, rock and/or groundwater was encountered at depths not much below the sample interval of 2.5 feet. Therefore, samples deeper than 2.5 feet were not collected at these locations. At the east location, the deepest sample was collected at a depth of approximately 4 feet bgs; deeper samples could not be collected because of the presence of groundwater below a depth of 4 feet bgs. A sample was collected from a depth of approximately 5 feet bgs at the south location.

A berm is located at DA 2 adjacent to the road on the south side of the area. The berm is approximately 45 feet long and four feet high and has an arcuate shape that is concave toward the road. Three soil samples were collected from the berm: one from the center of the berm, one from a location approximately 15 feet northeast and upslope of the berm center, and one from a location approximately 15 feet southwest and downslope of the berm center. Each sample was collected from a depth of approximately 2 feet at the midpoint of the berm height.

Samples were collected at four compass locations on the depression/crater berm at DA 3. The samples were collected using decontaminated stainless steel hand augers from successively deeper intervals: from the top 0–6 inches of soil and from approximately 2.5 feet bgs. The presence of standing water in the depression/crater precluded collection of soil samples from the center of the depression/crater. Therefore, a sample of water standing in the depression/crater was collected in lieu of collecting soil samples.

3.2 SAMPLE COLLECTION METHODS

Soil samples were collected in accordance with procedures in the approved SAP:

- If sample is the center grab sample, record the location using a satellite-based GPS unit. Otherwise, record the magnetic heading and distance from the center grab sample.
- Prepare location ID label, and photograph the undisturbed sample location with ID label in view.
- Put on a new pair of sampling gloves.
- Remove surface vegetation and debris, using care to minimize mixing of the soil.
- Place a new sheet of foil on the ground (or on portable table).
- Using a disposable plastic scoop, remove approximately 500 grams of soil from the top 0 to 6 inches. If this site is designated for field QC, increase the amount of soil collected.

- Place the soil on the top of the foil, and remove large objects.
- Continue adding soil until the required volume of soil has been collected.
- Fill sample containers from the location.
- Decontaminate all sampling equipment that is non-disposable, and place the foil, wooden spatula, kim wipes, sample gloves, and plastic scoop into a waste container.
- Place removed vegetation back into hole.

A permanent record for each sample was documented on personal digital assistants (PDAs) in the format of the summary tables in Appendix C of this report. The contents of the summary tables in Appendix C are the records made during sample collection. Samples were packed for daily shipment to the laboratory in accordance with procedures in Appendix B of the SAP. Samples were packed on ice in rigid coolers and picked up at the site for delivery to the laboratory. Ice was kept on the samples in the coolers until the time they were picked up, which was usually within 24 hours of sample collection.

Samples from muzzle blast zones at the small arms ranges were collected using stainless steel scoops, and samples from the demolition areas were collected using stainless steel scoops and hand augers. This non-disposable equipment was decontaminated using procedures in the SAP:

- Physically remove visible contaminants from sampling equipment by first scraping with a disposable wooden spatula, then rinsing with clean potable water.
- If visible contaminants still remain, remove with a scrub brush, then rinse with clean potable water.
- Wash equipment with non-phosphate detergent solution such as Alconox©.
- Rinse with deionized, contaminant-free water.
- Collect all liquids generated in decontamination.

3.3 SAMPLE AND PHOTOGRAPH NUMBERS

Unique sample identification numbers were assigned in accordance with procedures in the SAP:

- One space: The sampling matrix was "S" for soil
- Three spaces: The sample grid number. Sample grid numbers were assigned as follows:
  - Small arms range grids: 001 to 307
  - Duplicate samples: 308 to 499
  - Background samples: 501 to 520

  - Muzzle blast zone samples: 600s
  - Demolition Area 2: 700s
  - Demolition Area 3: 800s
- Five spaces: The sample date information recorded as "YMMDD"
- One space: The letter designating the location of the sample within a grid:
  - C – Center
  - N – North
  - S – South
  - E – East
  - W – West

The photograph of each sampling location was uniquely identified in accordance with procedures in the SAP:

- Six spaces: The photograph date information recorded as "MMDDYY"
- Four spaces: Time in military format
- Four spaces: Photograph number starting at P001 and extending to Q999

The unique sample numbers and corresponding photograph numbers are listed in the summary tables of sample locations presented in Appendix C of this report.

3.4 SAMPLE ANALYSES

Each small arms range grid soil sample was screened to remove clasts larger than 2 mm and each sample was analyzed for lead using EPA Method 7420. Results of the analyses are presented on a dry-weight basis. At 10 locations randomly selected from the range grids, soil samples were analyzed for the nine Priority Pollutant metals. Samples collected from background locations were analyzed for lead using EPA Method 7420 and samples from two randomly selected background locations were analyzed for Priority Pollutant metals. Samples collected in muzzle blast zones at the small arms ranges were analyzed using a modified EPA Method 8330 for explosive residues, including picric acid and PETN. Samples collected at DA 2 and DA 3 were analyzed for explosive residues, including picric acid and PETN, perchlorate, and Priority Pollutant metals. Additional details on sample analyses are given in Section 4.0 of this report.

3.5 INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW) generated during implementation of the SI included disposable personal protective gear, disposable sampling equipment (i.e., plastic scoops), foil used in the sampling procedure, and liquids generated during decontamination of non-disposable sampling equipment (i.e., stainless steel scoops and hand augers). Solid and liquid

IDW (plastic scoops/foil, decontamination liquids, respectively) were placed into separate sealed steel drums. IDW was properly transported to an approved treatment, storage, and disposal facility for disposal. Manifests for disposal of IDW are in Appendix F of this report.

SECTION 4.0
QUALITY ASSURANCE/QUALITY CONTROL

4.1 DATA MANAGEMENT

An Access® database was set up in Atlanta, Georgia, that contained a framework for all the samples to be collected during the field investigation. An Excel® workbook was also prepared that contained the same information as in the database and was organized according to the ranges and grids. The Excel spreadsheet was transferred to a PDA that was used in the field. The sample date and time were entered into the PDA for each sample collected.

Each day during the field investigation, the workbook was transferred back to Atlanta, with each workbook maintained as a separate file in order to document the daily receipt of field data. The project manager and system administrator verified the field data as to sample ID format and dates. The workbook data were then transferred to the Access database on a daily basis. The field data were again verified for consistency and format as they were transferred to the Access database.

The photo number, date, and time were also entered into the Excel workbook. In addition, the photograph files were also transmitted back to the Atlanta office. Each photograph was viewed in order to verify the sample location, and the photo ID was created. The photograph files were renamed with the photo ID.

The laboratory data were received in both electronic format (COELT 1.2a) and hard copy. The received electronic files are maintained separately to provide a log of the incorporated data files. No manual laboratory data entry into the database was performed. As the laboratory data were received in electronic format, the sample IDs were verified, and discrepancies were noted between the field data, COCs, and the laboratory recording of the sample ID from the chain-of-custody. All discrepancies were corrected by a review of the COC, laboratory receipt form, and field workbook.

A summation of the laboratory data was prepared as the data were received and communicated to the U.S. Army. After all data were received, the data were transferred electronically to Excel spreadsheets for summation. In addition, the data were electronically transferred to figures for data presentation. These Excel spreadsheets and figures were then verified against the laboratory data hard copy. No data discrepancies were found.

4.2 DATA REVIEW

The Data Quality Objectives (DQOs) for the Camp Bonneville sampling effort were specified in Table 8-1 of the QAPP. The applicable analyses and their DQOs are excerpted and presented as follows:

Measurement	EPA Method	Precision (RPD)	Accuracy (% REC)	Surrogate Recovery (%)	Completeness (%)
Metals (total)	6010B	+/-40	80–120	NA	95
Perchlorate	314	+/-20	NA	NA	95
Explosives	8330 Modified	+/-25	75–140 (tetryl 40–150)	60–130	95
Lead (Soil)	7420	+/-50	80–120	NA	90

Notes:
* = based on laboratory control sample
NA = not performed for this method
RPD = relative percent deviation

The measurement and achievement of the DQOs and other analytical QC issues are discussed below.

4.2.1 Precision

Precision is measured by the performance of laboratory duplicates and field duplicates. A summary of the laboratory duplicates is presented in Table 4-1. This table displays the number of detected duplicates, the number criteria for exceedances and the average RPD for each analyte. The only average exceedance of the precision criteria was for arsenic. There were only two detections in the laboratory duplicates, indicating that the precision may be poor at the lower limit of the detection range.

The field duplicate data are presented in Table 4-2. The average RPD is 25 percent over a total of 151 duplicates, which is 10 percent of the EPA Method 7420 analyses. The number of duplicates exceeding the RPD limit of 50 percent was 16. This indicates a reasonable degree of precision given the heterogeneous nature of the soil samples.

4.2.2 Accuracy

Two sets of spikes were analyzed for this project. One consisted of soil laboratory blank spikes for the lead analyses. These are especially prepared soil blanks, which have been verified as to their lead content. The number of blank spikes for the Method 7420 analyses was 276 and there were no exceedances of the laboratory control limits. There were 128 analyses of the blank spikes for lead by Method 6010B and there were two exceedances at a percent recovery of 124 percent with an upper control limit for these spikes of 123 percent.

The other spike samples that were analyzed were soil matrix spike samples. There were 69 spiked samples analyzed by Method 7420 and there were no exceedances of the control limits. There were 5 spiked samples analyzed by Method 6010B and there were no exceedances. There were 8 spiked samples analyzed for Method 8330 (modified) and there were no exceedances.

Therefore the project DQO for accuracy were met.

4.2.3 Surrogate Recovery

A surrogate, 3-chloronitrobenzene, was included in all of the Method 8330 (modified) analyses. The surrogate percent recovery for all analyses was within the control limits.

Therefore, the DQO for surrogate recovery was met.

4.2.4 Completeness

The planned analyses for all collected samples, including the Method 7420, 6010B, 8330 (modified), and perchlorate analyses, were completed satisfactorily. There were no rejected results. Only one planned sample was missed and that was a duplicate sample. However, the 10 percent rate for duplicate samples was still met.

Therefore, the completeness rate for each method of analyses was 100 percent, which exceeds the project DQO.

4.2.5 Detection Limits

The Camp Bonneville QAPP presents two sets of reporting limits. They are the Project Reporting Limit and the Quantitation Limit. The Project Reporting Limit is equivalent to the Estimated Quantitation Limit as described in Chapter 1 of the SW-846 Procedures Manual. It is the lowest concentration that can be reliably achieved during routine laboratory conditions. It is generally 5 to 10 times the SW-846 Method Detection Limit. The individual sample quantitation/ detection limit is the Project Reporting Limit adjusted for percent moisture and sample weight.

The Quantitation Limit as described in the QAPP is equivalent to the SW-846 Method Detection Limit. The Method Detection Limit is defined as the minimum concentration that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. Each laboratory will determine the Method Detection Limit for each analyte on a matrix-specific basis.

The analytical reports used a different nomenclature for the reporting limits and the detection limits. The following table presents the three terms in perspective.

QAPP Name	SW-846 Name	Laboratory Name	Description
Project Detection Limit	Estimated Quantitation Limit	Method Reporting Limit	The lowest concentration that can be reasonably achieved for all samples for the project.
Quantitation Limit	Method Detection Limit	Method Quantitation Limit	The minimum concentration that can be detected under good conditions.

The project detection limits or method reporting limits vary from sample to sample for the soil samples as noted above. This is because the soil sample results are expressed on a dry weight basis. In addition, the weight of the soil samples prepared for extraction can also vary. Because the soil samples had high moisture content, the laboratory weighed out approximately 25 percent more of the sample for the grid lead sample analyses to compensate for weight content of solids. The average percent solids for the samples collected from all areas was 67 percent with a minimum value of 21 percent and a maximum value of 92 percent. For example, if a sample had a percent solids of 21 percent, a lead concentration of 5 mg/kg expressed as wet weight would be 23 mg/kg (concentration/percent solids).

All calculated Method Reporting Limits were less than the respective benchmarks. All data were reported as compared to the respective Method Reporting Limits. An analyte was not considered detected in the data summary tables unless the concentration was greater than the Method Reporting Limit. Values between the Method Reporting Limits and the Method Quantitation Limits are reported as being qualified with a "J" (as estimated) in the laboratory data sheets.

4.2.6 Blanks

Method blanks were analyzed for each laboratory batch. The detections and the blank concentrations in the blank samples are found in Table 4-3. The blank concentrations did not exceed the method reporting limit for any analyte. A "B" flag was placed in the LNOTE field of the database for the samples potentially affected by the blanks.

4.3 QC SUMMARY

All DQOs for the project were met and no data were rejected because of a QC deviation. The data were maintained according to the procedures presented in the project Data Management Plan.

SECTION 5.0
COMPARISONS TO BENCHMARK VALUES

5.1 BENCHMARK VALUES

Laboratory results for the SI samples were compared to the Ecology MTCA and U.S. EPA Region 9 PRG benchmark values summarized in Table 5-1.

Table 5-1
MTCA and PRG Benchmark Values (mg/kg)

Constituent	Ecology MTCA			EPA Region 9 PRG	
	Unrestricted Land Uses[1]	Industrial Properties[2]	Ecological Indicator[8]	Residential Soil	Industrial Soil
Inorganic Constituents					
Antimony	NV[3]	NV	NV	31	820
Arsenic	20	20	132[9]	22[5]	440[5]
Barium	NV	NV	102	5,400	100,000
Cadmium	2	2	14	37	810
Chromium[4]	2,000	2,000	67[10]	100,000	100,000
Copper	NV	NV	217	2,900	76,400
Lead	250	1,000	118	400	750
Nickel	NV	NV	980	1,600[6]	41,000[6]
Zinc	NV	NV	360	23,000	100,000
Organic Constituents[7]					
HNX	NV	NV	NV	3,100	44,000
RDX	NV	NV	NV	4.4	22
1,3,5-TNB	NV	NV	NV	1,800	26,000
1,3-DNB	NV	NV	NV	6.1	88
Tetryl	NV	NV	NV	610	8,800
NB	NV	NV	NV	20	110
2,4,6-TNT	NV	NV	NV	16	82
4-Am-DNT	NV	NV	NV	NV	NV
2-Am-DNT	NV	NV	NV	NV	NV
2,4-DNT	NV	NV	NV	120	1,800
2,6-DNT	NV	NV	NV	61	880
2-NT	NV	NV	NV	370	1,000
3-NT	NV	NV	NV	370	1,000
4-NT	NV	NV	NV	370	1,000
Picric Acid	NV	NV	NV	NV	NV
PETN	NV	NV	NV	NV	NV
Perchlorate	NV	NV	NV	39	1,000

Notes
1 From Table 740-1, Method A Soil Cleanup Levels for Unrestricted Land Uses
2 From Table 745-1, Method A Soil Cleanup Levels for Industrial Properties
3 No benchmark value available
4 Chromium (III)
5 Benchmark value for non-cancer endpoint
6 Soluble salts
7 U.S. EPA Method 8330 compound list, modified to include picric acid and PETN, and perchlorate
8 From Table 749-3, Ecological Indicator Soil Concentrations for Wildlife for Future Industrial/ Commercial Use
9 Arsenic (V)
10 Total chromium

Tables with results from all samples collected during the SI (except duplicate samples) are presented in Appendix A of this report, and figures illustrating results from all samples collected during the SI (except duplicate samples) are presented in Appendix B.

5.2 LEAD AT SMALL ARMS RANGES

Concentrations of lead were larger than at least one of the benchmark values (BMV) at 12 of the 17 small arms ranges sampled during the SI. The numbers of samples at each range with lead concentrations greater than a benchmark value are summarized in Table 5-2.

Table 5-2
Lead Concentrations Greater Than Benchmark Values

Small Arms Range Designation	Lead Samples		
	Total	> BMV	% > BMV
Close Combat Range	120	0	0%
25 Meter M60 Range/Pistol Range	20	2	10.0%
Sub Machine Gun Range	35	0	0%
TF Range	40	0	0%
Rifle Ranges 1 & 2	160	18	11.3%
Field Fire Rifle Ranges 1 & 2	110	2	1.8%
Infiltration Course North	20	0	0%
Field Firing Ranges 1 & 2 and Pistol Range	70	8	11.4%
Undocumented Pistol Range	5	1	20.0%
1,000 Foot Range, 1,000 Foot Machine Gun and Moving Target Range	150	23	15.3%
Combat Pistol Range	85	2	2.4%
Machine Gun Range – South	130	2	1.5%
Machine Gun Range – North	165	1	0.6%
M31 Sub-Caliber Ranges 1 & 2	125	0	0%
25 Meter and Machine Gun Range	65	11	16.9%
Infiltration Course South	35	1	2.9%
25M Record Fire Field Range, Field Firing Range	200	6	3.0%
Totals	**1,535**	**77**	**5.0%**

Arrays of samples with lead concentrations greater than benchmark values at each small arms range are presented in Tables 5-2 to 5-14. Locations of samples with lead concentrations greater than benchmark values are illustrated in Figures 5-1 to 5-11.

Only five percent of the total samples had lead concentrations greater than any benchmark value, and 11 of the 17 ranges had either no samples with lead concentrations greater than a benchmark value, or fewer than five percent of the samples with lead concentrations greater than a benchmark value.

Of the 77 samples with lead concentrations greater than any benchmark value, 38 were greater than only the lowest value, the MTCA ecological indicator of 118 mg/kg. In another 9 samples lead concentrations were also greater than the MTCA value for unrestricted land uses (250 mg/kg), in another 9 samples concentrations were greater than the PRG value for residential soil (400 mg/kg), in another 3 samples concentrations were greater than the PRG value for industrial soil (750 mg/kg), and in another 18 samples lead concentrations were also greater than the MTCA value for industrial properties (1,000 mg/kg).

Samples with lead concentrations greater than 1,000 mg/kg were collected from the following ranges:

- Rifle Ranges 1 & 2 — 5 samples
- Field Fire Rifle Ranges 1 & 2 — 1 sample
- Field Firing Ranges 1 & 2/Pistol Range — 1 sample
- 1,000-Foot/Machine Gun/Moving Target Range — 6 samples
- 25-Meter and Machine Gun Range — 4 samples
- 25M Record Fire/Field Firing Range — 1 sample

Most of the samples from Rifle Ranges 1 & 2, the 1,000-Foot/Machine Gun/Moving Target Range, and the 25-Meter and Machine Gun Range were clustered in specific sampling grids. At Rifle Ranges 1 & 2, four of the five samples were collected from grid 073 (sample point RIFLE_RANGE-30 in the SAP) located at the eastern end of the range. The fifth sample was collected from grid 074 (RIFLE_RANGE-31) adjacent to grid 073.

Three of the six samples from the 1,000-Foot/Machine Gun/Moving Target Range were collected from grid 119 (1000FT-4) in the southern portion of the range. The grids adjacent to the eastern, western, and southern sides of grid 119, and the grid at the southwestern corner of grid 119 (there was no sampling grid at the southeastern corner of grid 119) yielded no samples with lead concentrations greater than any benchmark value. One sample from grid 123 (1000FT-8), adjacent to the northern side of grid 119, contained lead at a concentration greater than 1,000 mg/kg. Two samples with lead concentrations greater than 1,000 mg/kg were collected from grid 143 (1000FT-28) at the range berm.

Three of the four samples from the 25-Meter and Machine Gun Range were collected from grid 254 (25M_MG-8) located on the eastern side of the berm. The fourth sample was collected from grid 251 (25M_MG-5), also on the berm and adjacent to the southern side of grid 254. Of the 20 samples collected from the four grids located within the drop zone east of the berm, only two samples contained lead at a concentration greater than a benchmark value (120 mg/kg and 708 mg/kg), and no soil samples contained lead at a concentration greater than 1,000 mg/kg.

5.3 BACKGROUND CONCENTRATIONS OF LEAD

Concentrations of lead in samples from background locations ranged from 9.7 mg/kg to 80.8 mg/kg. The average concentration of the 20 background samples was 24.3 mg/kg (calculated using one half the detection limit of 10.2 mg/kg, or 5.1 mg/kg, for background sample number S50130224C). The highest lead concentration detected in a background sample is less than the lowest MTCA or PRG benchmark value (i.e., 118 mg/kg).

5.4 EXPLOSIVE RESIDUES

The explosive residue 2,4-dinitrotoluene (2,4-DNT) was detected in samples collected from the muzzle blast zone at the 25-Meter and Machine Gun Range. Concentrations of 2,4-DNT in the samples ranged from 4.9 mg/kg to 20 mg/kg, much less than the PRG benchmark values of 120 mg/kg for residential soil and 1,800 mg/kg for industrial soil.

Concentrations of explosive residues in all other samples collected from the muzzle blast zones at the small arms ranges were below method reporting limits, and therefore none of the muzzle blast zone samples had concentrations of explosive residues greater than benchmark values. None of the samples collected from DA 2 and DA 3 had detectable concentrations of explosive residues or perchlorate, and therefore none of these samples had concentrations of explosive residues or perchlorate greater than PRG benchmark values.

5.5 PRIORITY POLLUTANT METALS

Surface soil samples for analyses of nine Priority Pollutant metals analyzed by EPA Method 6010 (antimony, arsenic, barium, cadmium, chromium, copper, lead, nickel, and zinc) were collected from 10 locations randomly selected from the range grids, from two randomly selected background locations, and from DA 2 and DA 3.

Neither antimony nor cadmium was detected in any of the surface soil samples. Chromium, copper, lead, nickel, and zinc were detected in samples (including those from background locations), but at concentrations less than the lowest benchmark value. The only metals detected at concentrations greater than a benchmark value were arsenic and barium.

Concentrations of arsenic greater than a benchmark value were detected in one surface soil sample from Rifle Ranges 1 & 2, and in one surface soil sample from DA 2. Arsenic concentrations were greater than a benchmark value in four soil samples collected from depths of approximately 2.5 ft. to 5 ft. at DA 2, and in one sample from the DA 2 berm. The exceeded benchmark values were the MTCA values for unrestricted land use and industrial property (20 mg/kg) and the PRG value for residential soil (22 mg/kg). Arrays of samples with arsenic concentrations greater than benchmark values are presented in Table 5-15.

Concentrations of barium were greater than a benchmark value in each of the surface soil samples collected from the range grid, and in each of the soil samples collected at DA 2 and DA 3. Concentrations of barium in surface soil samples from background locations were 92.4 mg/kg and 156.0 mg/kg, the latter of which is greater than the MTCA ecological indicator of 102 mg/kg. Samples with barium concentrations greater than benchmark values are presented in

Table 5-16. A sample is included on the table only if the barium concentration was also greater than the average concentration of 124.2 mg/kg for the two background samples.

SECTION 6.0
REFERENCES

Environmental Science and Engineering, Inc. 1983. *Installation Assessment of the HQ, I Corps and Ft. Lewis, Washington and the Sub Installation Yakima Firing Center, Camp Bonneville, and Vancouver Barracks.*

Geo Recon International. 1981. *Cultural Resources Survey, Forest Management Project, Ft. Lewis and Camp Bonneville, Washington, for U.S. Army, Ft. Lewis.*

Hart Crowser. 1996. *Petroleum Contaminated Soil Investigation, Former Tank No. 7-CMBPN, Building No. 4475, Camp Bonneville Washington.* Contract No. DACA 67-93-D-1004. September 1996.

Mundorff, MR. 1964. *Geology and Groundwater Conditions of Clark County, Washington, with a Description of Major Alluvial Aquifer Supply along the Columbia River.* U.S. Geological Survey Water Supply Paper 1600, 268 p.

Phillips, WIMP. 1987. *Geologic Map of the Vancouver Quadrangle, Washington and Oregon.* Washington Division of Geology and Earth Resources Open File Report 87-10, scale 1:100,000.

Shannon & Wilson. 1999a. *Final Report Volume 1 Multi-Sites Investigations, Camp Bonneville, Washington.* Contract No. DACA 67-94-D-1014. July 1999.

Shannon & Wilson. 1999b. *Final Landfill 4 Investigation Report, Camp Bonneville, Washington.* Contract DACA 67-94-D-1014. August 1999.

TABLES

Table 4-1
Comparison of Lead Concentrations in Duplicate Samples
Camp Bonneville

Original Sample ID	Duplicate Sample ID	Original Concentration (mg/kg)	Duplicate Concentration (mg/kg)	Relative Percent Deviation (%a)
S02330303S	S31930303S	16.1	12.7	23.61
S02630304C	S32030304C	21.8	10.9	66.67
S03030303E	S32330303E	6.9	9.5	-31.71
S03230303W	S32430303W	6.8	7.8	-13.70
S03430303N	S32530303N	10.4	5.2	66.67
S03630307W	S32630307W	9.4	10.5	-11.06
S03830310N	S32730310N	20.1	19.4	3.54
S04030310S	S32830310S	16.4	16.3	0.61
S04330307S	S32930307S	9.3	8.3	11.36
S04430225S	S33030225S	11.4	10.9	4.48
S04630225E	S33130225E	15.6	22.9	-37.92
S00130305S	S30830305S	7.2	13	-57.43
S00330304E	S30930304E	17.2	9.9	53.87
S00530305N	S31030305N	9	13.5	-40.00
S00930305W	S31230305W	16.5	45.3	-93.20
S01130304S	S31330304S	12.8	8.2	43.81
S01330305E	S31430305E	16	22.4	-33.33
S01530304N	S31530304N	9.4	8.5	10.06
S01730305C	S31630305C	10.7	15.1	-34.11
S01930304E	S31730304E	7.9	8	-1.26
S02130303W	S31830303W	19.1	11.7	48.05
S04830225N	S33230225N	22.5	24	-6.45
S05030225C	S33330225C	17	14.4	16.56
S05230225W	S33430225W	18.7	20.9	-11.11
S05430225S	S33530225S	49.3	18.8	89.57
S05630226E	S33630226E	7.9	11.6	-37.95
S05830225N	S33730225N	108	99.1	8.59
S06030226C	S33830226C	17	16.1	5.44
S06230226E	S33930226E	14.4	16.9	-15.97
S06430226W	S34030226W	14	13.1	6.64
S06630226S	S34130226S	19.1	24.1	-23.15
S06830226S	S34230226S	212	119	56.19
S07030226E	S34330226E	21.6	27	-22.22
S07830228E	S34730228E	13.5	19.4	-35.87
S08030228N	S34830228N	7.4	7.3	1.36
S08230228C	S34930228C	18.7	21.3	-13.00
S08430228W	S35030228W	10.2	14.1	-32.10
S08630228S	S35130228S	61	64.5	-5.58
S08830228E	S35230228E	5.4	13.1	-83.24
S09030228N	S35330228N	9.1	10.8	-17.09
S09230228C	S35430228C	32.3	38.1	-16.48
S09430228E	S35530228E	149	140	6.23
S09630301W	S35630301W	24.7	24.6	0.41
S09930301C	S35730301C	4.9	3.9	22.73
S10030301E	S35830301E	10.9	15.3	-33.59
S10430317E	S36030317E	154	77.1	66.55
S10630312N	S36130312N	9.2	11.6	-23.08
S10830312C	S36230312C	9.2	7.9	15.20

Table 4-1
Comparison of Lead Concentrations in Duplicate Samples
Camp Bonneville

Original Sample ID	Duplicate Sample ID	Original Concentration (mg/kg)	Duplicate Concentration (mg/kg)	Relative Percent Deviation (%a)
S11030312W	S36330312W	19.6	19.2	2.06
S11230312S	S36430312S	20.4	26.9	-27.48
S11430312E	S36530312E	24.6	23.4	5.00
S11630314S	S36730314S	3.4	2.6	26.67
S11830314E	S36830314E	7.8	9.2	-16.47
S12030314N	S36930314N	14.8	13.8	6.99
S12230314C	S37030314C	21.5	12.9	50.00
S12430314W	S37130314W	17.4	23.7	-30.66
S12630314S	S37230314S	11.4	10.7	6.33
S12830310E	S37330310E	18.6	21.6	-14.93
S13030310N	S37430310N	11.9	13	-8.84
S13230310C	S37530310C	17	17	0.00
S13430310E	S37630310E	11.7	12.7	-8.20
S13630310W	S37730310W	13.8	10.8	24.39
S13830310S	S37830310S	15.2	8.7	54.39
S14030310S	S37930310S	13.4	14	-4.38
S14230310E	S38030310E	68.5	75.7	-9.99
S14430310N	S38130310N	15.1	20.8	-31.75
S14630313S	S38230313S	23.3	27.4	-16.17
S14830313E	S38330313E	43	10.9	119.11
S15030313N	S38430313N	17.2	38.4	-76.26
S15230312C	S38530312C	19.8	16.7	16.99
S15430313W	S38630313W	8.7	31.7	-113.86
S15630313S	S38730313S	15.2	15	1.32
S15830313E	S38830313E	35.5	41.2	-14.86
S16030313N	S38930313N	12	13.4	-11.02
S16230313C	S39030313C	12.3	20.5	-50.00
S16330317S	S39130317S	8	9	-11.76
S16530317E	S39230317E	13.5	12.7	6.11
S16730317N	S39330317N	12.3	11.9	3.31
S16930317C	S39430317C	8.9	8.3	6.98
S17130318W	S39530318W	13.6	13.6	0.00
S17330318S	S39630318S	11.9	10.5	12.50
S17530318E	S39730318E	12.1	12.9	-6.40
S17730318N	S39830318N	11.5	10.6	8.14
S17930318C	S39930318C	13.4	13.1	2.26
S18130318E	S40030318E	12.7	14.1	-10.45
S18330318W	S40130318W	18.8	19.1	-1.58
S18530318S	S40230318S	15	16.5	-9.52
S18730318S	S40330318S	18.5	18.2	1.63
S18930311S	S40430311S	26.5	21.3	21.76
S19130311E	S40530311E	17.8	14.3	21.81
S19330311N	S40630311N	17.1	14.5	16.46
S19530307C	S40730307C	18	22.1	-20.45
S19730311W	S40830311W	18.7	16.5	12.50
S19930307S	S40930307S	18.4	24.7	-29.23
S20130307E	S41030307E	7	7.9	-12.08
S20330307N	S41130307N	20	34.8	-54.01

Table 4-1
Comparison of Lead Concentrations in Duplicate Samples
Camp Bonneville

Original Sample ID	Duplicate Sample ID	Original Concentration (mg/kg)	Duplicate Concentration (mg/kg)	Relative Percent Deviation (%a)
S20530311C	S41230311C	13.4	4.2	104.55
S20730311E	S41330311E	34.9	32.4	7.43
S20930311W	S41430311W	22.5	20.7	8.33
S21130311S	S41530311S	13.5	15.2	-11.85
S21330311S	S41630311S	18.1	18.2	-0.55
S21530311E	S41730311E	18.9	20.1	-6.15
S21730311N	S41830311N	16.8	3.8	126.21
S21930311C	S41930311C	38.3	8.7	125.96
S22230319S	S42030319S	8.4	10.4	-21.28
S22430319E	S42130319E	51.3	58.8	-13.62
S22630319N	S42230319N	15.5	13.3	15.28
S22830320C	S42330320C	11.9	12.1	-1.67
S23030320W	S42430320W	8.2	8.8	-7.06
S23230320S	S42530320S	12.6	14	-10.53
S23430319E	S42630319E	14.3	15.3	-6.76
S23630319N	S42730319N	11.2	12.4	-10.17
S23830319C	S42830319C	11.5	12.6	-9.13
S24030319E	S42930319E	8	8.3	-3.68
S24230319W	S43030319W	8.5	11.2	-27.41
S24430319S	S43130319S	13.8	14.3	-3.56
S24730306S	S43330306S	13.7	13.4	2.21
S24930306E	S43430306E	17.2	14.1	19.81
S25130306N	S43530306N	2180	1950	11.14
S25330306C	S43630306C	45.4	26.9	51.18
S25530306W	S43730306W	10.8	8.8	20.41
S25730306S	S43830306S	13	7.8	50.00
S25930306E	S43930306E	11	8	31.58
S26030306S	S44130306S	15.8	16.4	-3.73
S26230306E	S44230306E	11	12.7	-14.35
S26430306N	S44330306N	12.9	16.3	-23.29
S26630306C	S44430306C	17.1	13.4	24.26
S26730317S	S44630317S	9.7	10	-3.05
S26930317E	S44730317E	10.5	11.3	-7.34
S27130317N	S44830317N	21	19.9	5.38
S27330317C	S44930317C	13	15.3	-16.25
S27530315W	S45030315W	11.2	11	1.80
S27730315S	S45130315S	9	9.9	-9.52
S27930315E	S45230315E	12.1	9.4	25.12
S28130315N	S45330315N	19.9	16.4	19.28
S28330315C	S45430315C	12.7	8.2	43.06
S28530315E	S45530315E	90.3	28.3	104.55
S28730315W	S45630315W	23.6	18.3	25.30
S28930315S	S45730315S	14	10.5	28.57
S29130315S	S45830315S	24.3	18	29.79
S29330315E	S45930315E	11.9	8.9	28.85
S29530314N	S46030314N	18.5	19.8	-6.79
S29730314C	S46130314C	31.7	28.8	9.59
S29830314S	S46230314S	16.2	9.8	49.23

Table 4-1
Comparison of Lead Concentrations in Duplicate Samples
Camp Bonneville

Original Sample ID	Duplicate Sample ID	Original Concentration (mg/kg)	Duplicate Concentration (mg/kg)	Relative Percent Deviation (%a)
S30030314E	S46330314E	296	175	51.38
S30230317N	S46430317N	10	10.6	-5.83
S30430317C	S46530317C	8.7	9.5	-8.79
S80830227C	S46730227C	3.8	5.7	-40.00
S80830227C	S46730227C	10.3	5.7	57.50
S80830227C	S46730227C	3.8	3.9	-2.60
S80830227C	S46730227C	10.3	3.9	90.14
	Average Absolute Relative Percent Deviation			25.29
	Number greater than 50%			16.00

Table 4-2
Laboratory Duplicates Summary
Camp Bonneville

Method	Analyte	RPD Limit	Number of Exceedances	Number of Duplicates	Average RPD
SW6010B	SB	40	1	4	36
SW6010B	AS	40	1	2	51
SW6010B	BA	40	0	7	4
SW6010B	CD	40	1	5	33
SW6010B	CR	40	0	7	5
SW6010B	CU	40	0	7	8
SW6010B	NI	40	0	7	6
SW6010B	PB	40	0	12	5
SW6010B	ZN	40	0	7	5
SW7420	PB	40	6	218	8
SW8330	HMX	40	0	8	14
SW8330	RDX	40	0	9	17
SW8330	TNB135	40	0	8	10
SW8330	DNB13	40	0	8	13
SW8330	TETRYL	40	0	8	13
SW8330	NO2BZ	40	0	8	21
SW8330	TNT	40	0	8	13
SW8330	A4DNT26	40	0	8	18
SW8330	A2DNT46	40	0	8	13
SW8330	DNT24	40	0	8	13
SW8330	DNT26	40	0	8	16
SW8330	NBZME2	40	0	8	13
SW8330	NBZME3	40	0	8	22
SW8330	NBZME4	40	0	8	17
SW8330	PICRICACID	40	1	8	21
SW8330	PETN	40	0	8	13

Table 4-3
Blank Sample Detections
Camp Bonneville

Laboratory Control Batch	Analytical Method	Analyte	Blank Concentration
KP0311643	SW6010B	CD	0.1
KP0311459	SW6010B	CD	0.5
KP0311643	SW6010B	CD	0.1
KP0311036	SW6010B	CU	1.1
KP0311036	SW6010B	CU	1.1
KP0311036	SW6010B	NI	0.4
KP0311036	SW6010B	NI	0.4
KP0311459	SW6010B	ZN	0.6
KP0311676	SW6010B	ZN	0.87
KP0311676	SW6010B	ZN	0.87
KP0311424	SW7420	PB	1.5
KP0310556	SW7420	PB	1.3
KP0311427	SW7420	PB	1.2
KP0311365	SW7420	PB	1.3
KP0310768	SW7420	PB	1.3
KP0311111	SW7420	PB	1
KP0311423	SW7420	PB	2.2
KP0311404	SW7420	PB	0.8
KP0311409	SW7420	PB	0.8
KP0311382	SW7420	PB	1.2
KP0311043	SW7420	PB	0.8
KP0311393	SW7420	PB	0.8
KP0311366	SW7420	PB	0.8
KP0311388	SW7420	PB	0.8
KP0311110	SW7420	PB	1
KP0311042	SW7420	PB	1.2
KWG0302975	SW8330	DNT26	0.11
KWG0302975	SW8330	DNT26	0.11
KWG0302975	SW8330	DNT26	0.11
KWG0302975	SW8330	HMX	0.14
KWG0302975	SW8330	HMX	0.14
KWG0302975	SW8330	HMX	0.14

Table 5-3
25-Meter M60 Range/Pistol Range - Lead Samples
Comparisons to MTCA and PRG Benchmark Values

Sampling Results			Concentration Greater than Benchmark Value				
Sample Point ID	Sample Number	Lead (mg/Kg)	MTCA Ecological Indicator (118 mg/Kg)	MTCA Unrestricted Land Use (250 mg/Kg)	PRG Residential Soil (400mg/kg)	PRG Industrial Soil (750 mg/Kg)	MTCA Industrial Property (1,000 mg/Kg)
25M_M60-3	S02730304N	136	**X**				
	S02730304E	219	**X**				

Table 5-4
Rifle Ranges 1 and 2 - Lead Samples
Comparisons to MTCA and PRG Benchmark Values

Sampling Results			Concentration Greater than Benchmark Value				
Sample Point ID	Sample Number	Lead (mg/Kg)	MTCA Ecological Indicator (118 mg/Kg)	MTCA Unrestricted Land Use (250 mg/Kg)	PRG Residential Soil (400mg/kg)	PRG Industrial Soil (750 mg/Kg)	MTCA Industrial Property (1,000 mg/Kg)
RIFLE_RANGE-21	S06430226E	290	X	X			
RIFLE_RANGE-23	S06630226E	130	X				
RIFLE_RANGE-24	S06730226W	132	X				
RIFLE_RANGE-25	S06830226N	145	X				
	S06830226S	212	X				
	S06830226E	172	X				
RIFLE_RANGE-29	S07230226N	137	X				
RIFLE_RANGE-30	S07330226C	273	X	X			
	S07330226N	1,690	X	X	X	X	X
	S07330226S	1,750	X	X	X	X	X
	S07330226E	1850	X	X	X	X	X
	S07330226W	4330	X	X	X	X	X
RIFLE_RANGE-31	S07430226C	199	X				
	S07430226E	180	X				
	S07430226W	1770	X	X	X	X	X
RIFLE_RANGE-32	S07530226S	417	X	X	X		
	S07530226E	670	X	X	X		
	S07530226W	220	X				

Table 5-5
Field Fire Rifle Ranges 1 and 2 - Lead Samples
Comparisons to MTCA and PRG Benchmark Values

Sampling Results			Concentration Greater than Benchmark Value				
Sample Point ID	Sample Number	Lead (mg/Kg)	MTCA Ecological Indicator (118 mg/Kg)	MTCA Unrestricted Land Use (250 mg/Kg)	PRG Residential Soil (400mg/kg)	PRG Industrial Soil (750 mg/Kg)	MTCA Industrial Property (1,000 mg/Kg)
FIELD_FIRING_RIFLE-14	S08930228E	2300	X	X	X	X	X
FIELD_FIRING_RIFLE-19	S09430228E	149	X				

Table 5-6
Field Firing Ranges 1 and 2 and Pistol Range - Lead Samples
Comparisons to MTCA and PRG Benchmark Values

Sampling Results			Concentration Greater than Benchmark Value				
Sample Point ID	Sample Number	Lead (mg/Kg)	MTCA Ecological Indicator (118 mg/Kg)	MTCA Unrestricted Land Use (250 mg/Kg)	PRG Residential Soil (400mg/kg)	PRG Industrial Soil (750 mg/Kg)	MTCA Industrial Property (1,000 mg/Kg)
FIELD_FIRING-3	S10430317S	259	X	X			
	S10430317E	154	X				
FIELD_FIRING-9	S11030312E	136	X				
FIELD_FIRING-12	S11330312C	7150	X	X	X	X	X
	S11330312N	125	X				
	S11330312S	267	X	X			
	S11330312E	728	X	X	X		
	S11330312W	187	X				

Table 5-7
Undocumented Pistol Range - Lead Samples
Comparisons to MTCA and PRG Benchmark Values

Sampling Results			Concentration Greater than Benchmark Value				
Sample Point ID	Sample Number	Lead (mg/Kg)	MTCA Ecological Indicator (118 mg/Kg)	MTCA Unrestricted Land Use (250 mg/Kg)	PRG Residential Soil (400mg/kg)	PRG Industrial Soil (750 mg/Kg)	MTCA Industrial Property (1,000 mg/Kg)
UNDOC_PISTOL-1	S30730301E	154	X				

Table 5-8
1,000-Foot Range, 1,000-Foot Machine Gun Range, and Moving Target Range - Lead Samples
Comparisons to MTCA and PRG Benchmark Values

Sampling Results			Concentration Greater than Benchmark Value				
Sample Point ID	Sample Number	Lead (mg/Kg)	MTCA Ecological Indicator (118 mg/Kg)	MTCA Unrestricted Land Use (250 mg/Kg)	PRG Residential Soil (400mg/kg)	PRG Industrial Soil (750 mg/Kg)	MTCA Industrial Property (1,000 mg/Kg)
1000FT-4	S11930314C	3450	X	X	X	X	X
	S11930314N	10200	X	X	X	X	X
	S11930314S	438	X	X	X		
	S11930314W	2350	X	X	X	X	X
1000FT-8	S12330314C	871	X	X	X	X	
	S12330314S	4560	X	X	X	X	X
	S12330314E	198	X				
	S12330314W	566	X	X	X		
1000FT-24	S13930310N	128	X				
	S13930310W	146	X				
1000FT-26	S14130310E	282	X	X			
	S14130310W	172	X				
1000FT-27	S14230310C	241	X				
	S14230310S	346	X	X			
	S14230310W	136	X				
1000FT-28	S14330310C	334	X	X			
	S14330310N	279	X	X			
	S14330310S	7610	X	X	X	X	X
	S14330310E	2350	X	X	X	X	X
	S14330310W	210	X				
1000FT-29	S14430310E	216	X				
1000FT-30	S14530310C	120	X				
	S14530310E	170	X				

Table 5-9
Combat Pistol Range - Lead Samples
Comparisons to MTCA and PRG Benchmark Values

Sampling Results			Concentration Greater than Benchmark Value				
Sample Point ID	Sample Number	Lead (mg/Kg)	MTCA Ecological Indicator (118 mg/Kg)	MTCA Unrestricted Land Use (250 mg/Kg)	PRG Residential Soil (400mg/kg)	PRG Industrial Soil (750 mg/Kg)	MTCA Industrial Property (1,000 mg/Kg)
COMB_PISTOL-4	S14930312E	165	X				
COMB_PISTOL-15	S16030313W	785	X	X	X	X	

Table 5-10
Machine Gun Range (South) - Lead Samples
Comparisons to MTCA and PRG Benchmark Values

Sampling Results			Concentration Greater than Benchmark Value				
Sample Point ID	Sample Number	Lead (mg/Kg)	MTCA Ecological Indicator (118 mg/Kg)	MTCA Unrestricted Land Use (250 mg/Kg)	PRG Residential Soil (400mg/kg)	PRG Industrial Soil (750 mg/Kg)	MTCA Industrial Property (1,000 mg/Kg)
MG_NORTH-5	S16730317E	135	X				
MG_NORTH-24	S18630318E	423	X	X	X		

Table 5-11
Machine Gun Range (North) - Lead Samples
Comparisons to MTCA and PRG Benchmark Values

Sampling Results			Concentration Greater than Benchmark Value				
Sample Point ID	Sample Number	Lead (mg/Kg)	MTCA Ecological Indicator (118 mg/Kg)	MTCA Unrestricted Land Use (250 mg/Kg)	PRG Residential Soil (400mg/kg)	PRG Industrial Soil (750 mg/Kg)	MTCA Industrial Property (1,000 mg/Kg)
MG_SOUTH-8	S19630311C	158	X				

Table 5-12
25-Meter and Machine Gun Range - Lead Samples
Comparisons to MTCA and PRG Benchmark Values

Sampling Results			Concentration Greater than Benchmark Value				
Sample Point ID	Sample Number	Lead (mg/Kg)	MTCA Ecological Indicator (118 mg/Kg)	MTCA Unrestricted Land Use (250 mg/Kg)	PRG Residential Soil (400mg/kg)	PRG Industrial Soil (750 mg/Kg)	MTCA Industrial Property (1,000 mg/Kg)
25M_MG-5	S25130306C	214	X				
	S25130306N	2180	X	X	X	X	X
25M_MG-7	S25330306S	126	X				
25M_MG-8	S25430306C	26300	X	X	X	X	X
	S25430306N	1330	X	X	X	X	X
	S25430306S	964	X	X	X	X	
	S25430306E	429	X	X	X		
	S25430306W	4550	X	X	X	X	X
25M_MG-9	S25530306C	204	X				
25M_MG-10	S25630306C	120	X				
25M_MG-11	S25730306N	708	X	X	X		

Table 5-13
Infiltration Course South - Lead Samples
Comparisons to MTCA and PRG Benchmark Values

Sampling Results			Concentration Greater than Benchmark Value				
Sample Point ID	Sample Number	Lead (mg/Kg)	MTCA Ecological Indicator (118 mg/Kg)	MTCA Unrestricted Land Use (250 mg/Kg)	PRG Residential Soil (400mg/kg)	PRG Industrial Soil (750 mg/Kg)	MTCA Industrial Property (1,000 mg/Kg)
INFIL_SOUTH-1	S26030306W	151	X				

Table 5-14
25M Record Fire Field Range, Field Firing Range - Lead Samples
Comparisons to MTCA and PRG Benchmark Values

Sampling Results			Concentration Greater than Benchmark Value				
Sample Point ID	Sample Number	Lead (mg/Kg)	MTCA Ecological Indicator (118 mg/Kg)	MTCA Unrestricted Land Use (250 mg/Kg)	PRG Residential Soil (400mg/kg)	PRG Industrial Soil (750 mg/Kg)	MTCA Industrial Property (1,000 mg/Kg)
25M_RECORD-30	S29630314C	163	X				
25M_RECORD-33	S29930314N	647	X	X	X		
25M_RECORD-34	S30030314C	150	X				
	S30030314S	238	X				
	S30030314E	296	X	X			
	S30030314W	8880	X	X	X	X	X

Table 5-15
Comparisons of Arsenic Concentrations to MTCA and PRG Benchmark Values

Sampling Results			Concentration Greater than Benchmark Value				
Sample Location	Sample Number	Arsenic (mg/Kg)	MTCA Unrestricted Land Use (20 mg/Kg)	MTCA Industrial Property (20 mg/Kg)	PRG Residential Soil (22mg/kg)	MTCA Ecological Indicator (132 mg/Kg)	PRG Industrial Soil (440 mg/Kg)
Rifle Ranges 1&2	S46830227C	22.9	X	X	X		
DA 2 - 100 ft. South of Center - 5 ft.	S70930227C	28.5	X	X	X		
DA 2 - 100 ft. East of Center - 2.5 ft.	S71130227C	29.4	X	X	X		
DA 2 - 100 ft. East of Center - 4 ft.	S71230227C	23.6	X	X	X		
DA 2 - 100 ft. West of Center - Surface	S71330227C	30.1	X	X	X		
DA 2 - 100 ft. West of Center - 2.5 ft.	S71430227C	29.7	X	X	X		
DA 2 - Berm - Northeast - 2 ft.	S71830227C	29.3	X	X	X		

Table 5-16
Comparisons of Barium Concentrations to MTCA and PRG Benchmark Values

Sample Location	Sample Number	Barium (mg/Kg)	MTCA Ecological Indicator (102 mg/Kg)	PRG Residential Soil (5,400 mg/kg)	PRG Industrial Soil (100,000 mg/Kg)
1,000 Foot Range	S13830310C	137.0	X		
Close Combat Range	S01930304C	227.0	X		
Close Combat Range	S02130303C	145.0	X		
Field Fire Rifle Ranges 1&2	S07930228C	146.0	X		
Field Fire Rifle Ranges 1&2	S09030228C	194.0	X		
Machine Gun Range (South)	S18030318	192.0	X		
Machine Gun Range (North)	S20330307C	178.0	X		
Machine Gun Range (North)	S20630311C	200.0	X		
Rifle Ranges 1&2	S03530303C	202.0	X		
Sub Machine Gun Range	S03530303C	133.0	X		
TF Range	S04030307C	163.0	X		
DA 2 - Center of Area - Surface	S70130227C	152.0	X		
DA 2 - Center of Area - 2.5 ft.	S70230227C	121.0	X		
DA 2 - 100 ft. North of center - Surface	S70430227C	208.0	X		
DA 2 - 100 ft. North of center - 2.5 ft.	S70530227C	215.0	X		
DA 2 - 100 ft. South of Center - Surface	S70730227C	166.0	X		
DA 2 - 100 ft. South of Center - 2.5 ft.	S70830227C	180.0	X		
DA 2 - 100 ft. South of Center - 5 ft.	S70930227C	123.0	X		
DA 2 - 100 ft. East of Center - Surface	S71030227C	228.0	X		
DA 2 - 100 ft. East of Center - 2.5 ft.	S71130227C	262.0	X		
DA 2 - 100 ft. East of Center - 4 ft.	S71230227C	454.0	X		
DA 2 - 100 ft. West of Center - Surface	S71330227C	181.0	X		
DA 2 - 100 ft. West of Center - 2.5 ft.	S71430227C	130.0	X		
DA 2 - Berm - Southwest - 2 ft.	S71630227C	264.0	X		
DA 2 - Berm - Center - 2 ft.	S71730227C	246.0	X		
DA 2 - Berm - Northeast - 2 ft.	S71830227C	313.0	X		
Background Location	S51730320C	156.0	X		

Note: There were no values for the MCTA Unrestricted and Industrial Properties Land Uses

FIGURES

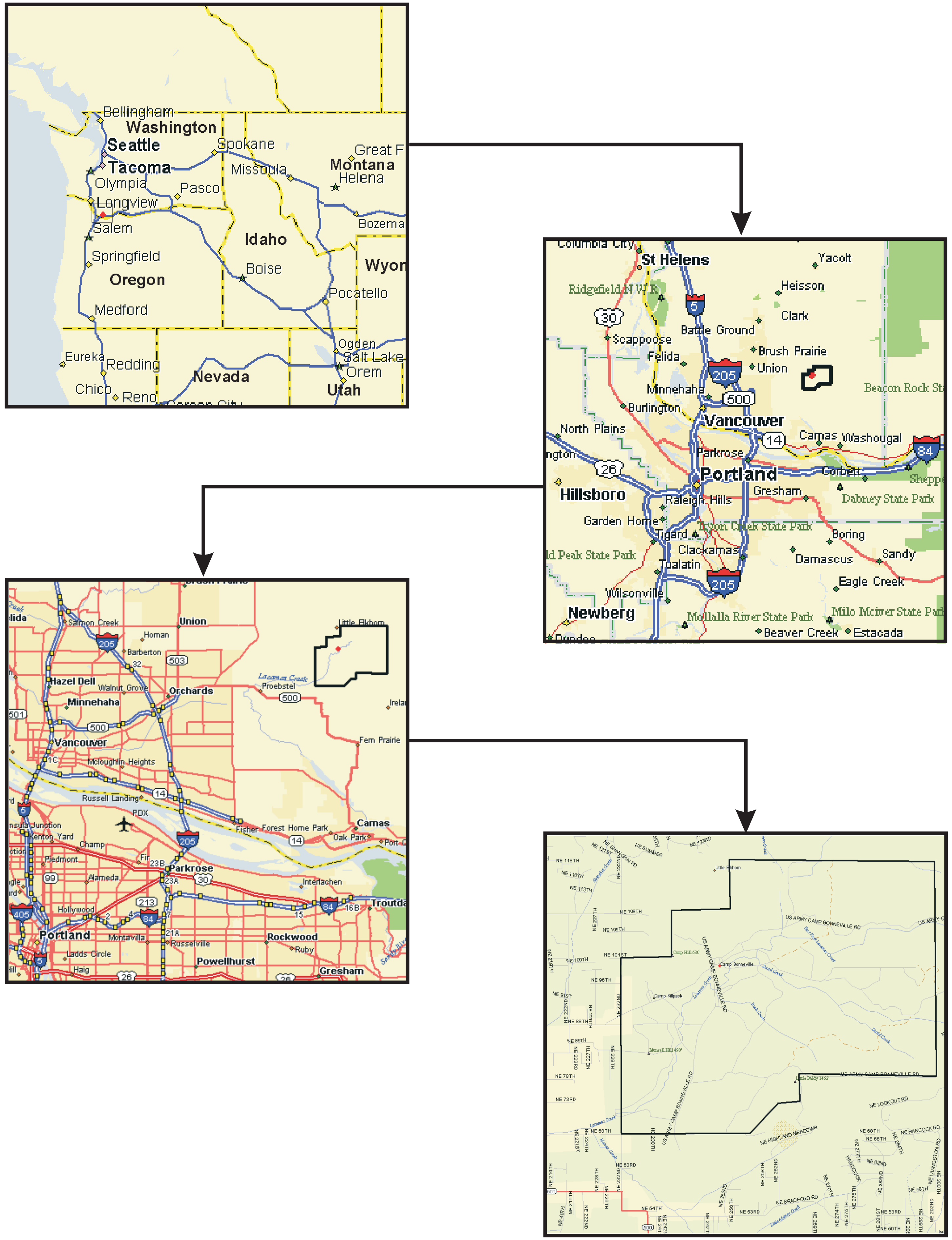

Figure 2-1

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Site Vicinity and Location

N

W E

S

August 15, 2003

ATLANTA ENVIRONMENTAL MANAGEMENT, INC.

Environmental Consulting, Engineering, Hydrogeologic Services

2580 Northeast Expressway • Atlanta, Georgia 30345

Office (404) 329-9006 • Fax (404) 329-2057

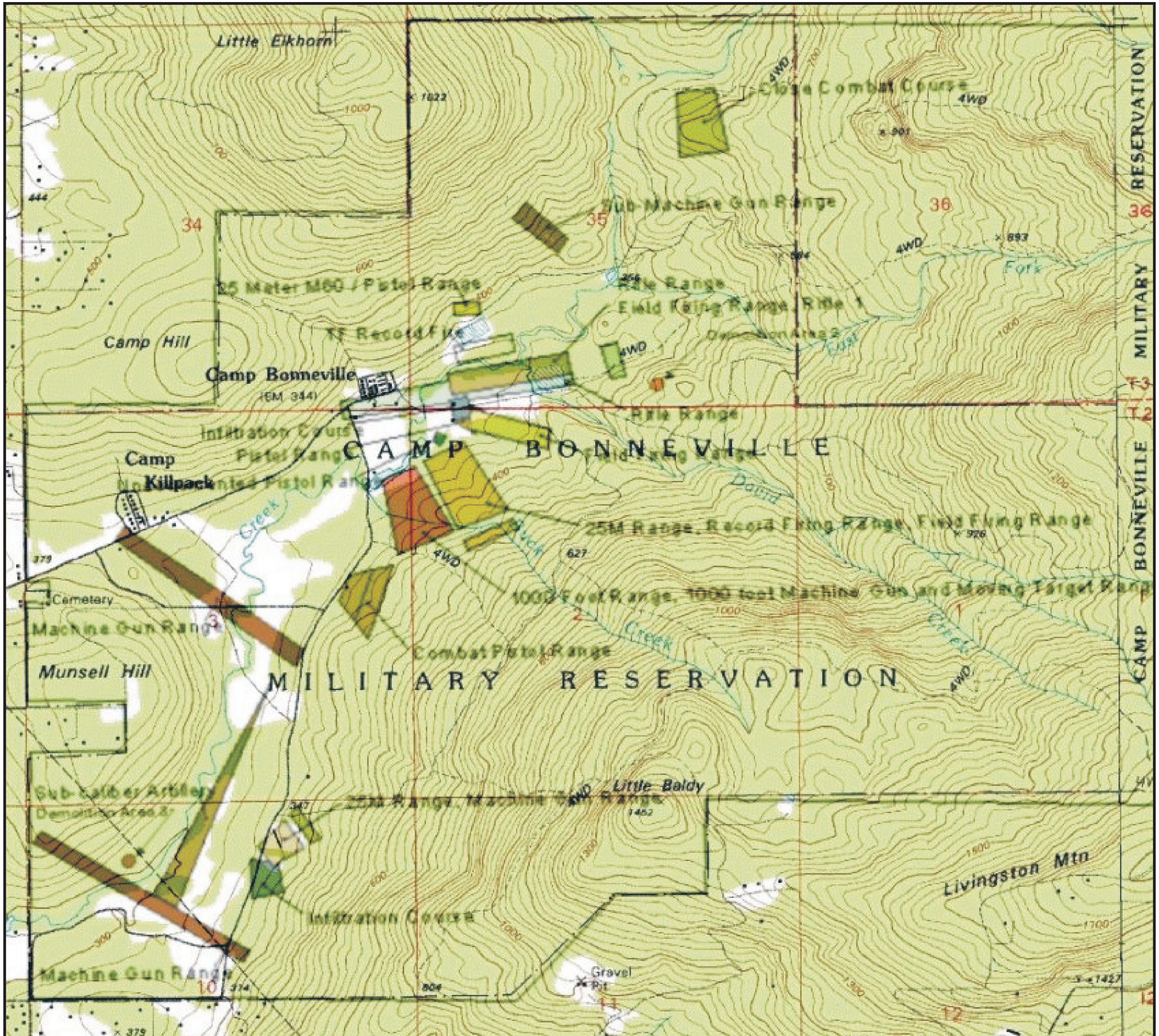

Figure 2-2

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Topography

N

W E

S

2000 0 1000 2000 4000

1 inch = 2000 ft.

August 15, 2003

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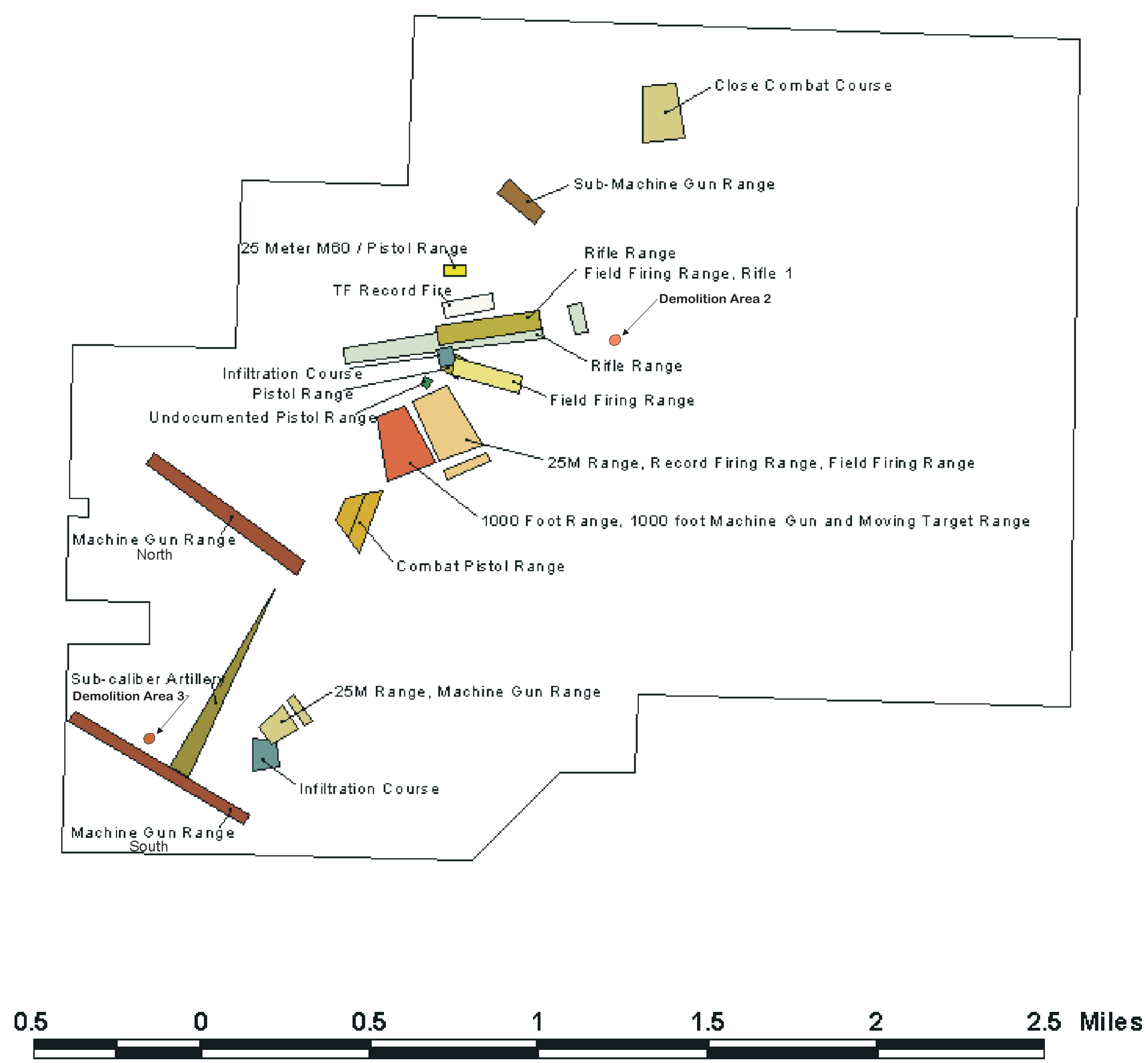

Figure 3-1

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Small Arms Ranges and Demolition Areas 2 and 3 within Camp Bonneville

Legend

Range Footprint

- 1000 Foot Range, 1000 foot Machine Gun and Moving Target Range
- 25 Meter M60 / Pistol Range
- 25M Range, Machine Gun Range
- 25M Range, Record Firing Range, Field Firing Range
- Close Combat Course
- Combat Pistol Range
- **Demolition Area #2**
- **Demolotion Area #3**
- Field Firing Range
- Field Firing Range, Rifle 1
- Infiltration Course
- Machine Gun Range
- Pistol Range
- Rifle Range
- Sub-Machine Gun Range
- Sub-caliber Artillery
- TF Record Fire
- Undocumented Pistol Range
- Boundary

N
W E
S

August 15, 2003

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Figure 3-2

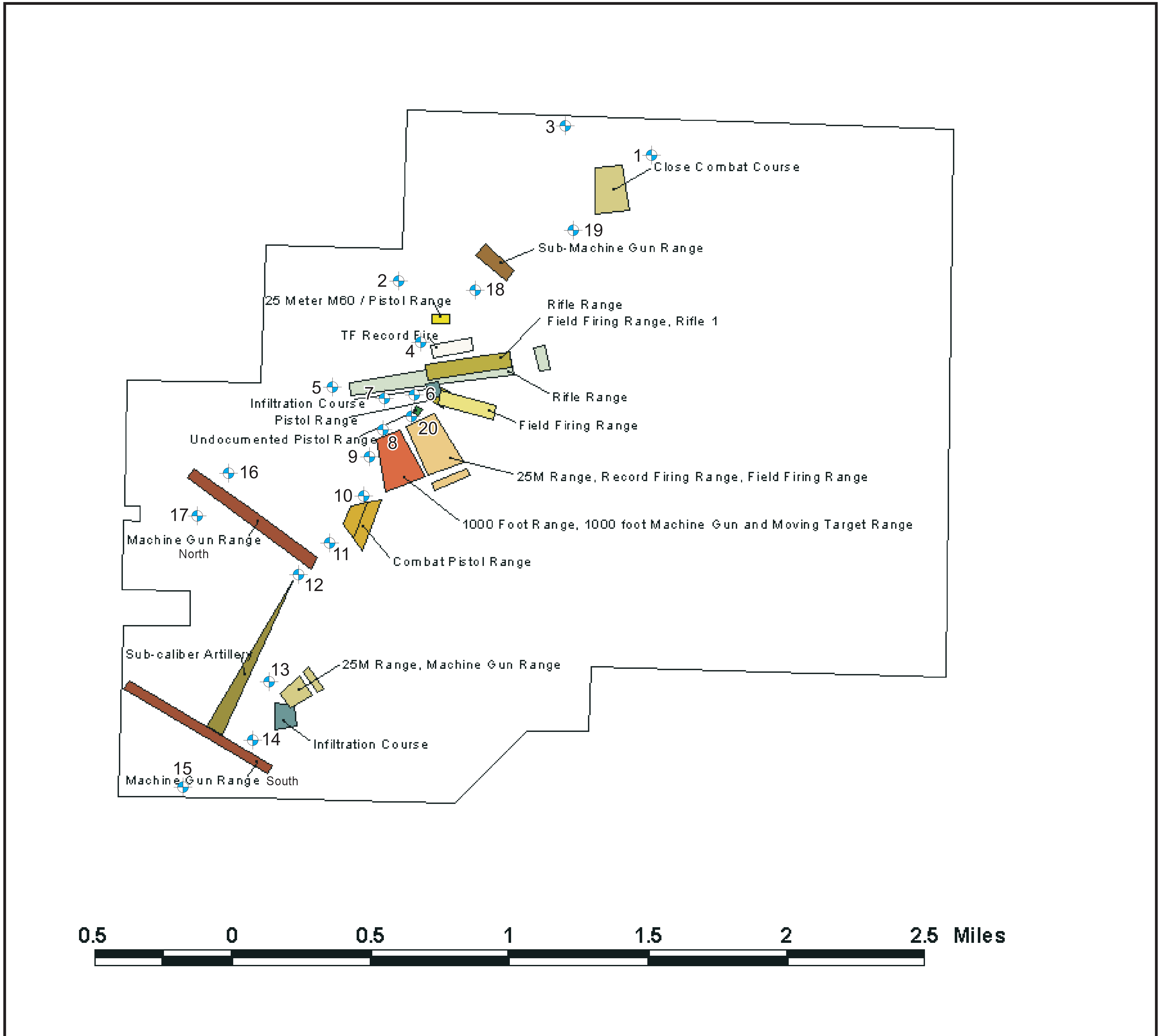
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Locations of Background Samples



Legend

Range Footprint

- 1000 Foot Range, 1000 foot Machine Gun and Moving Target Range
- 25 Meter M60 / Pistol Range
- 25M Range, Machine Gun Range
- 25M Range, Record Firing Range, Field Firing Range
- Close Combat Course
- Combat Pistol Range
- Demolition Area #2
- Demolotion Area #3
- Field Firing Range
- Field Firing Range, Rifle 1
- Infiltration Course
- Machine Gun Range
- Pistol Range
- Rifle Range
- Sub-Machine Gun Range
- Sub-caliber Artillery
- TF Record Fire
- Undocumented Pistol Range
- Boundary

Background Sample Location

N

W E

S

August 15, 2003

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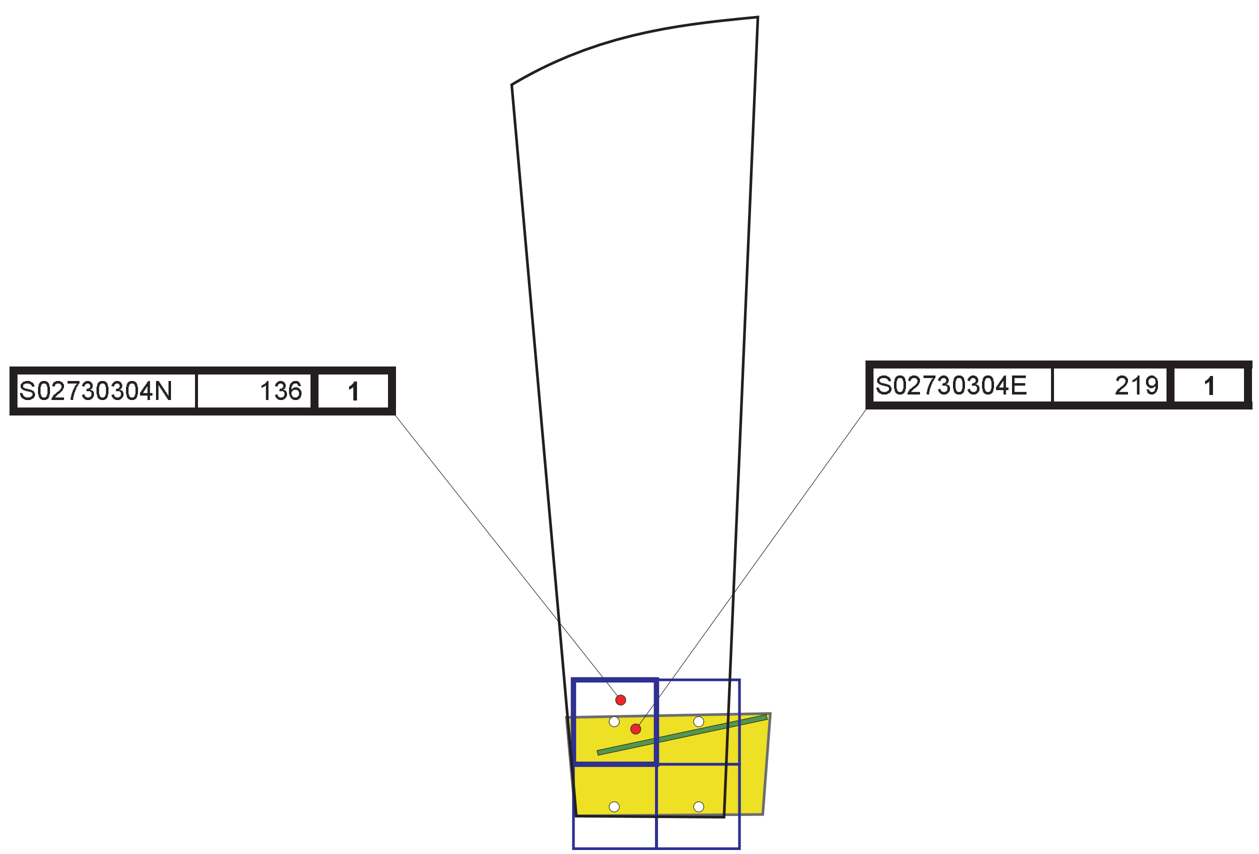


Benchmark Code
Lead Results by Method 7420 (mg/Kg)
Sample Number

S02730304N	136	1

Benchmark Code*
Benchmark Value

1	MTCA Ecological Indicator (118 mg/Kg)
2	MTCA Unrestricted Land Use (250 mg/Kg)
3	PRG Residential Soil (400 mg/Kg)
4	PRG Industrial Soil (750 mg/Kg)
5	MTCA Industrial Property (1,000 mg/Kg)

* The benchmark code indicates the largest benchmark value surpassed by the lead concentration in the sample.

Figure 5-1

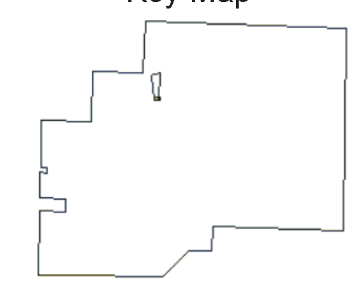
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

25 Meter M60 Range/Pistol Range Lead Results Greater than Benchmark Values (mg/Kg)

Key Map

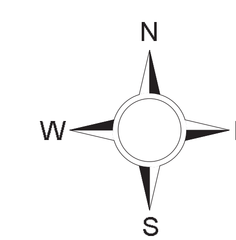


Legend

- **Sampling Grid**

Sampling Grid
- **Sampling Grid Center Point**
- **Sample Location Surpassing Benchmark Values**
- **Berm**
- **Range Fan**

Range Footprint
- **25 Meter M60 Range/Pistol Range**



August 15, 2003

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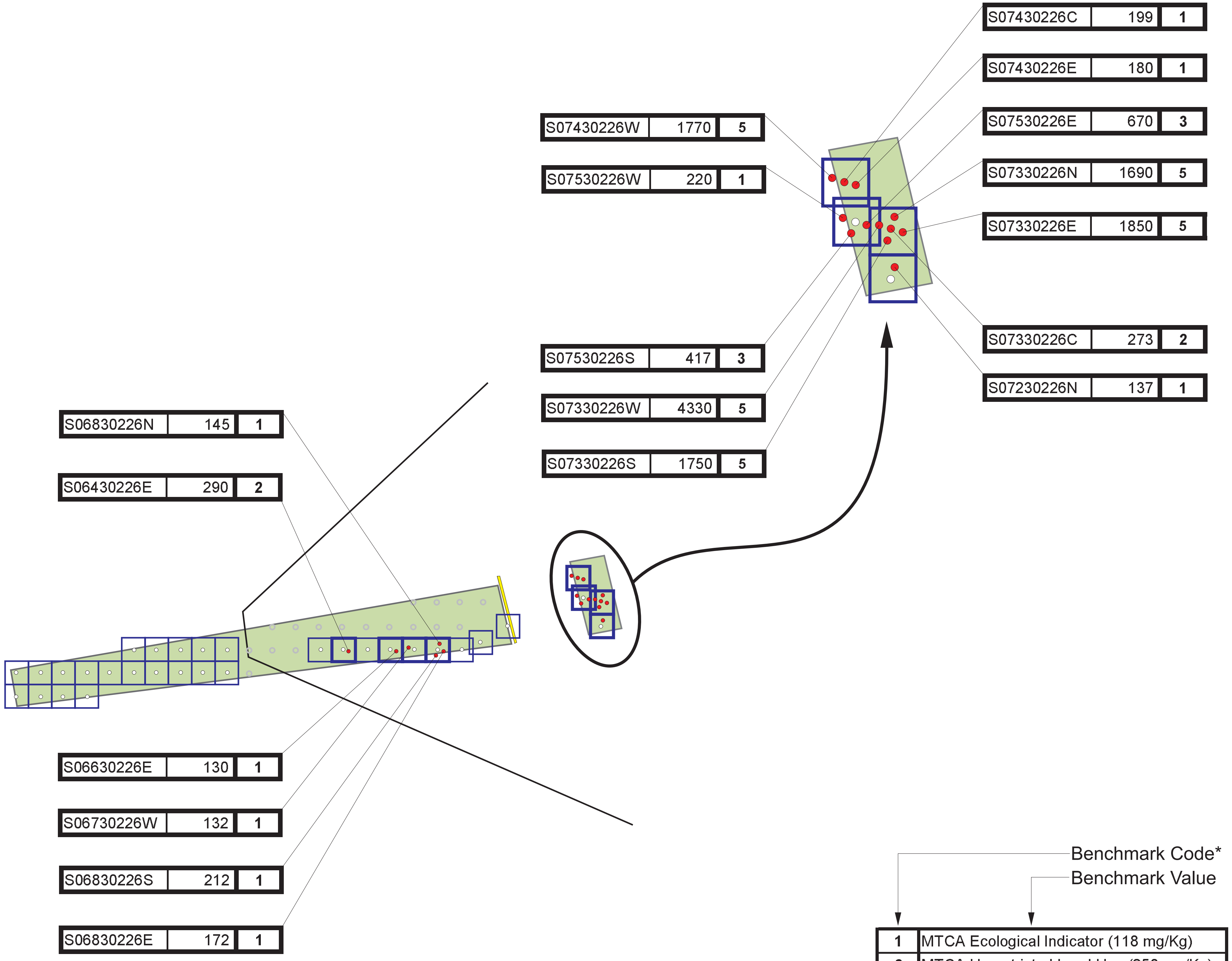
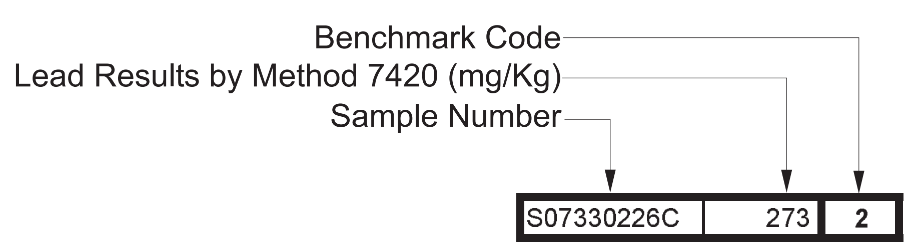


1	MTCA Ecological Indicator (118 mg/Kg)
2	MTCA Unrestricted Land Use (250 mg/Kg)
3	PRG Residential Soil (400 mg/Kg)
4	PRG Industrial Soil (750 mg/Kg)
5	MTCA Industrial Property (1,000 mg/Kg)



* The benchmark code indicates the largest benchmark value surpassed by the lead concentration in the sample.

Figure 5-2

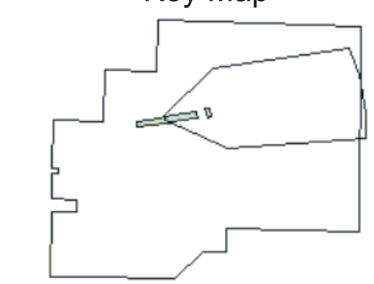
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

Rifle Ranges 1&2 Lead Results Greater than Benchmark Values (mg/Kg)

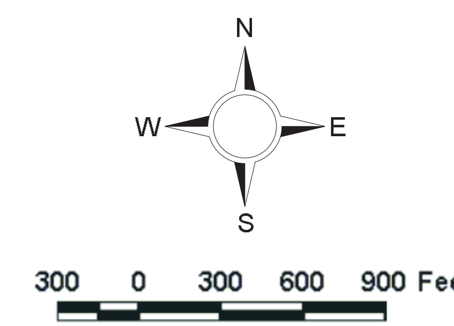
Key Map



Legend

- Sampling Grid
- Infiltration Course Sample Location
- Sampling Grid Center Point
- Sample Location Surpassing Benchmark Values
- Berm
- Range Fan

Range Footprint
- Rifle Range



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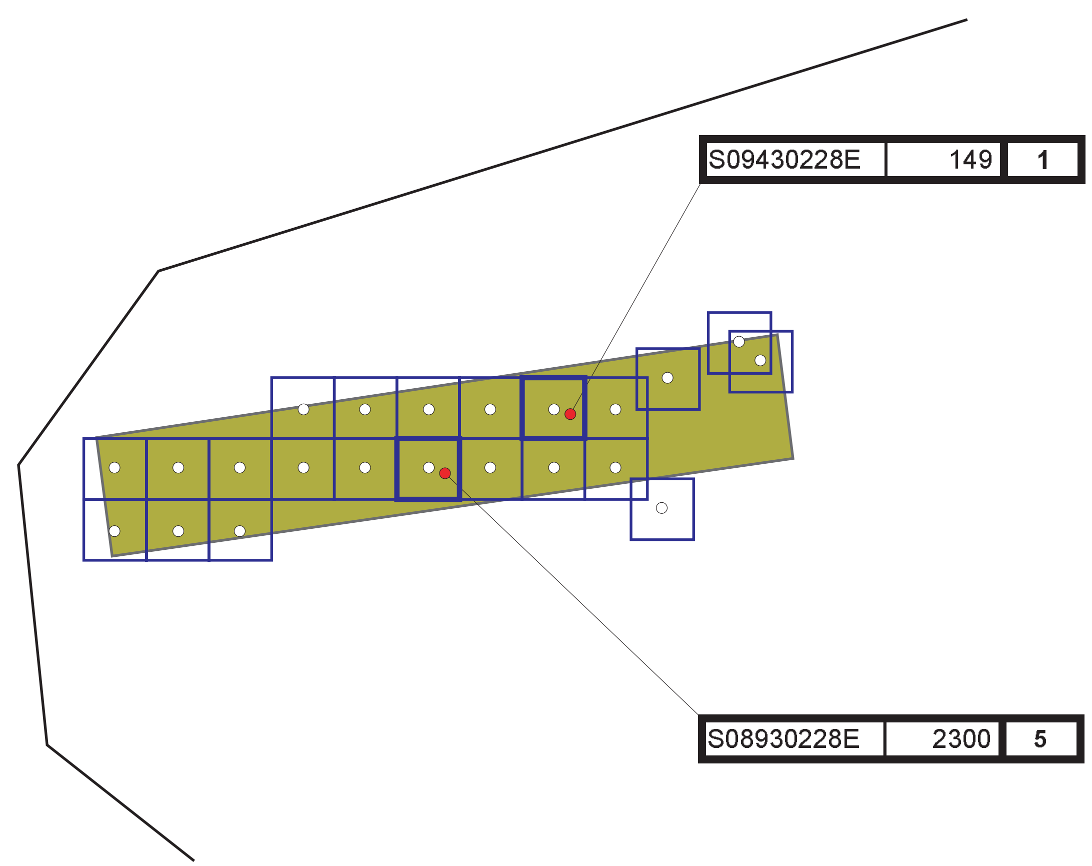


Benchmark Code*
Benchmark Value

1	MTCA Ecological Indicator (118 mg/Kg)
2	MTCA Unrestricted Land Use (250 mg/Kg)
3	PRG Residential Soil (400 mg/Kg)
4	PRG Industrial Soil (750 mg/Kg)
5	MTCA Industrial Property (1,000 mg/Kg)

Benchmark Code
Lead Results by Method 7420 (mg/Kg)
Sample Number

S09430228E	149	1

* The benchmark code indicates the largest benchmark value surpassed by the lead concentration in the sample.

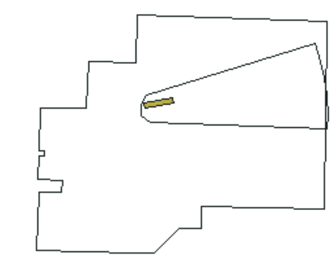
Figure 5-3

Camp Bonneville

Vancouver, Washington
Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

Field Fire Rifle Range 1 & 2
Lead Results Greater than Benchmark Values (mg/Kg)

Key Map



Legend

- Sampling Grid
- Sampling Grid Center Point
- Sample Location Surpassing Benchmark Values
- Range Fan

Range Footprint
- Field Fire Rifle Range 1 & 2

N
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S

200 0 200 400 600 800 1000 Feet

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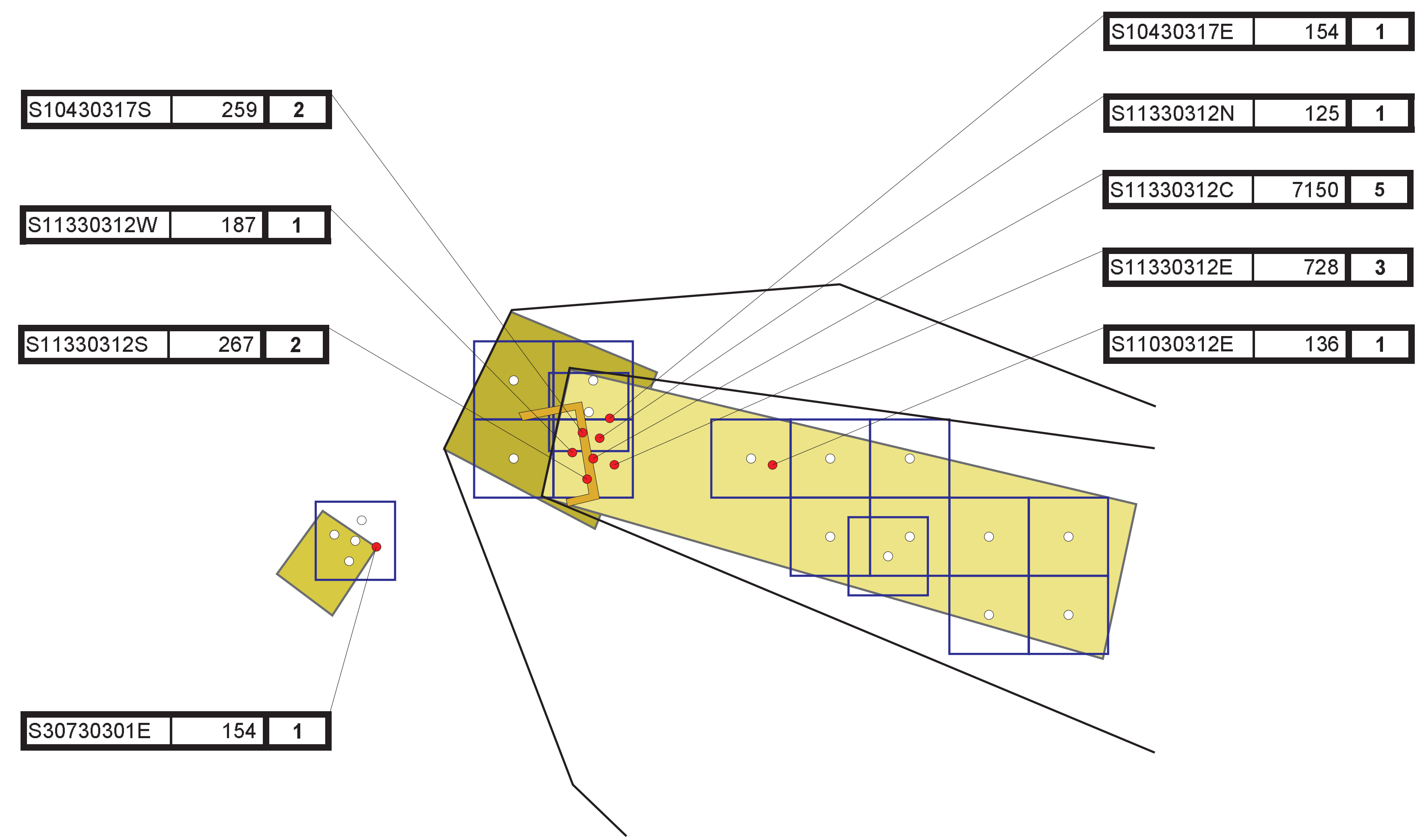


Benchmark Code*
Benchmark Value

1	MTCA Ecological Indicator (118 mg/Kg)
2	MTCA Unrestricted Land Use (250 mg/Kg)
3	PRG Residential Soil (400 mg/Kg)
4	PRG Industrial Soil (750 mg/Kg)
5	MTCA Industrial Property (1,000 mg/Kg)

* The benchmark code indicates the largest benchmark value surpassed by the lead concentration in the sample.

Benchmark Code
Lead Results by Method 7420 (mg/Kg)
Sample Number

S11030312E	136	1

Figure 5-4

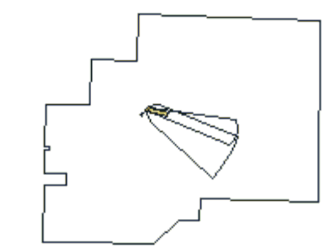
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

Field Firing Ranges 1 & 2 and Undocumented Pistol Range Lead Results Greater than Benchmark Values (mg/Kg)

Key Map



Legend

- Sampling Grid
- Sampling Grid Center Point
- Sample Location Surpassing Benchmark Values
- Range Fan
- Field Firing Ranges 1&2 and Pistol Range Berm

Range Footprint

- Field Firing Range
- Pistol Range
- Undocumented Pistol Range

N
W E
S

200 0 200 400 600 Feet

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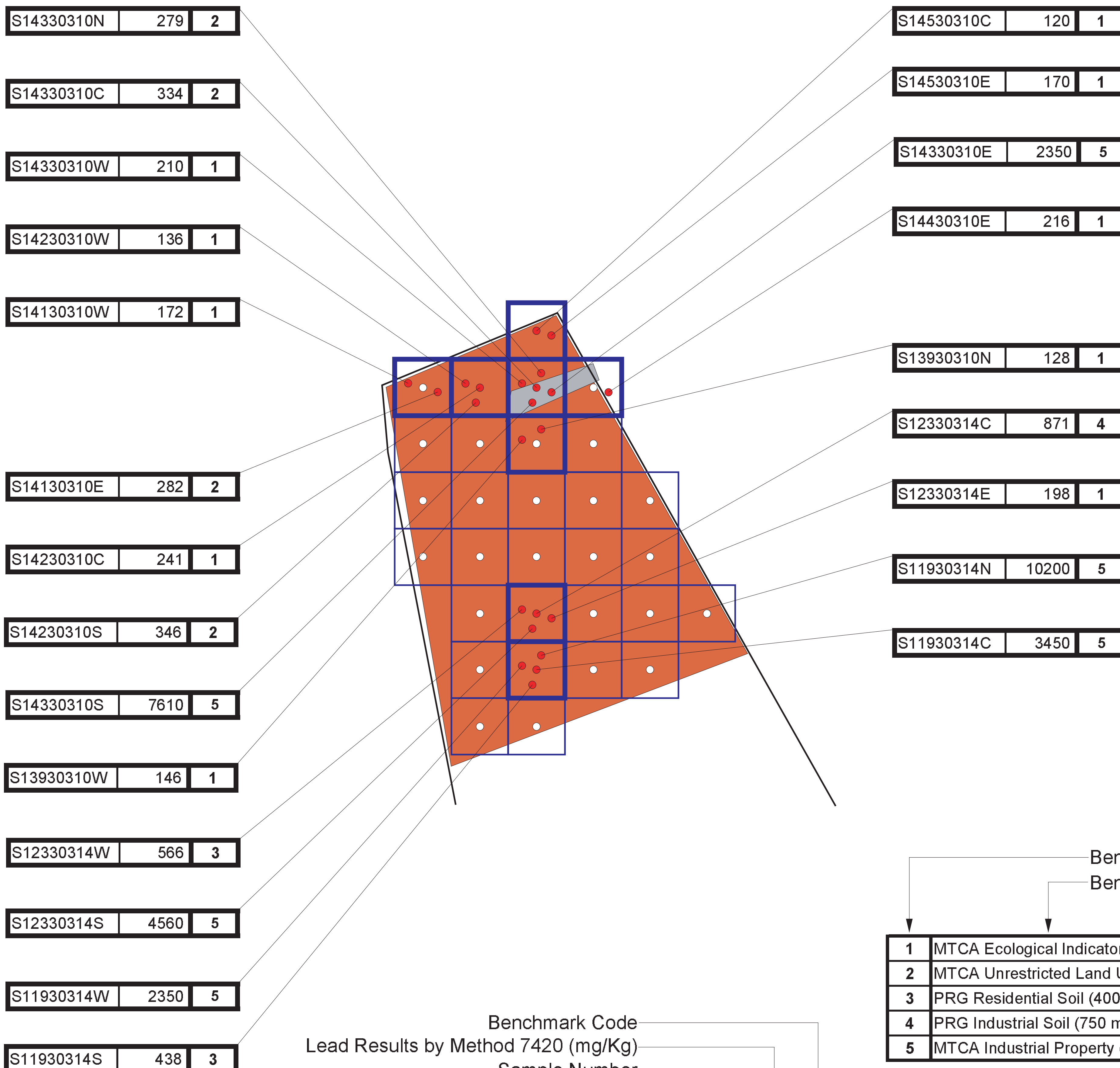
Figure 5-5

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

1000 Ft. Range, 1000 Ft. Machine Gun, and Moving Target Range Lead Results Greater than Benchmark Values (mg/Kg)



Benchmark Code
Lead Results by Method 7420 (mg/Kg)
Sample Number

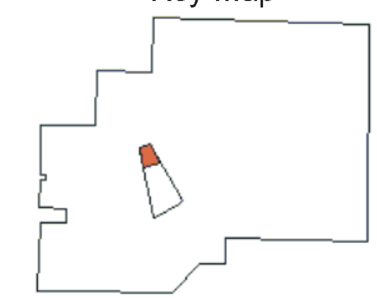
S11030312E 136 1

Benchmark Code*
Benchmark Value

1	MTCA Ecological Indicator (118 mg/Kg)
2	MTCA Unrestricted Land Use (250 mg/Kg)
3	PRG Residential Soil (400 mg/Kg)
4	PRG Industrial Soil (750 mg/Kg)
5	MTCA Industrial Property (1,000 mg/Kg)

* The benchmark code indicates the largest benchmark value surpassed by the lead concentration in the sample.

Key Map

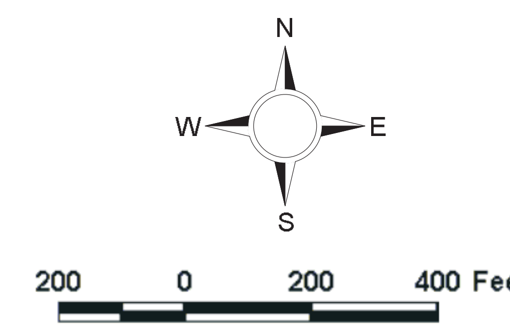


Legend

- Sampling Grid
- Sampling Grid Center Point
- Sample Location Surpassing Benchmark Values
- Range Fan
- 1000 Foot Range/1000 Foot Machine Gun Range and Moving Target Berm

Range Footprint

- 1000 Foot Range/1000 Foot Machine Gun Range and Moving Target



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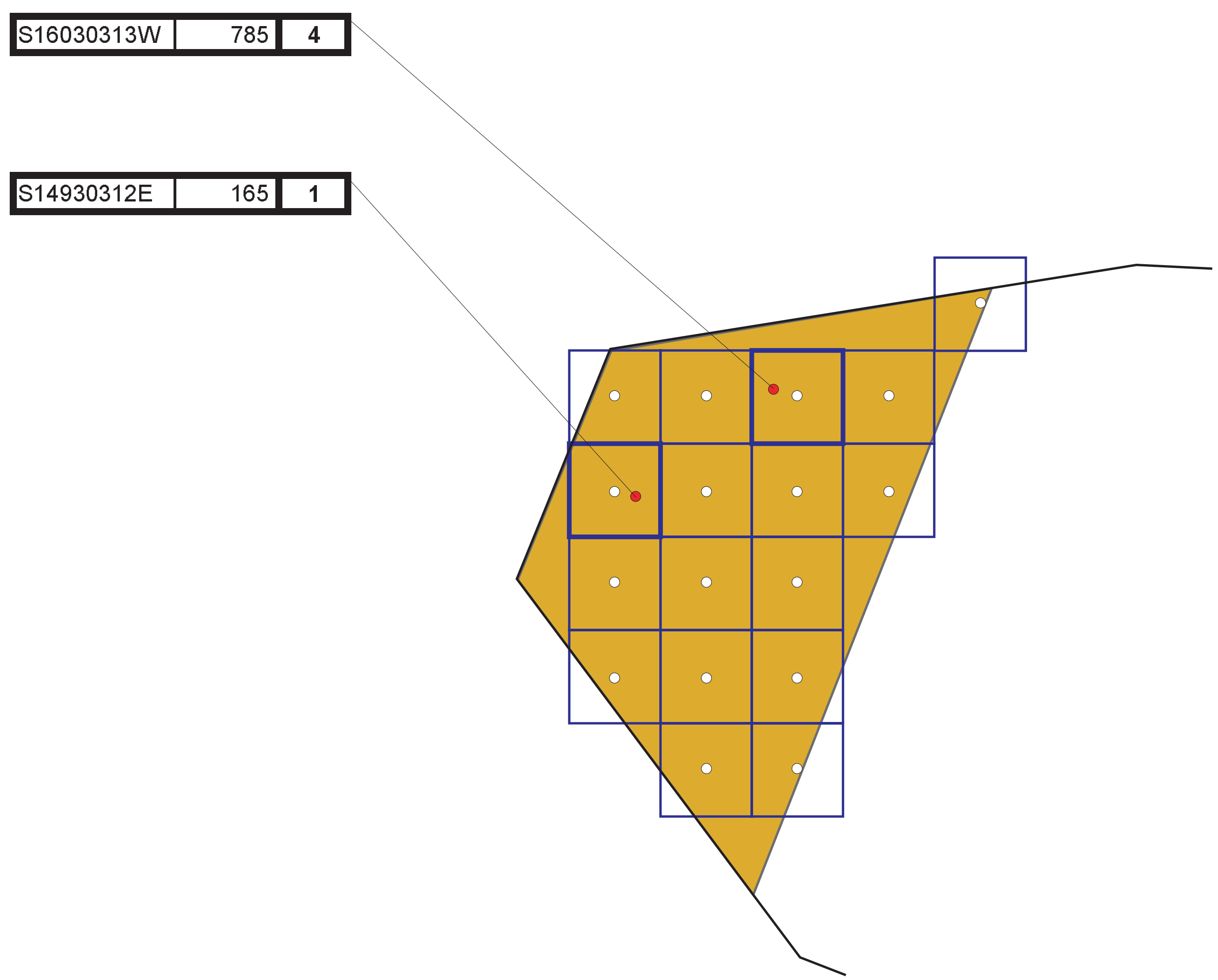


Benchmark Code
Lead Results by Method 7420 (mg/Kg)
Sample Number

Sample Number	Lead Results by Method 7420 (mg/Kg)	Benchmark Code
S11030312E	136	1

Benchmark Code*
Benchmark Value

1	MTCA Ecological Indicator (118 mg/Kg)
2	MTCA Unrestricted Land Use (250 mg/Kg)
3	PRG Residential Soil (400 mg/Kg)
4	PRG Industrial Soil (750 mg/Kg)
5	MTCA Industrial Property (1,000 mg/Kg)

* The benchmark code indicates the largest benchmark value surpassed by the lead concentration in the sample.

Figure 5-6

Camp Bonneville

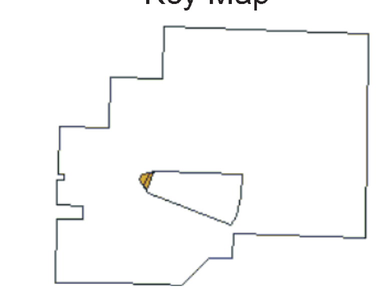
Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

Combat Pistol Range

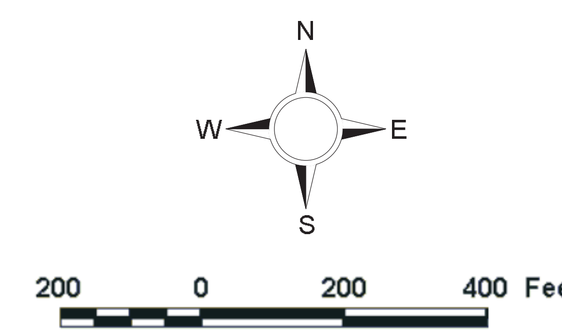
Lead Results Greater than Benchmark Values (mg/Kg)

Key Map



Legend

Sampling Grid
Sampling Grid Center Point
Sample Location Surpassing Benchmark Values
Range Fan
Range Footprint
Combat Pistol Range



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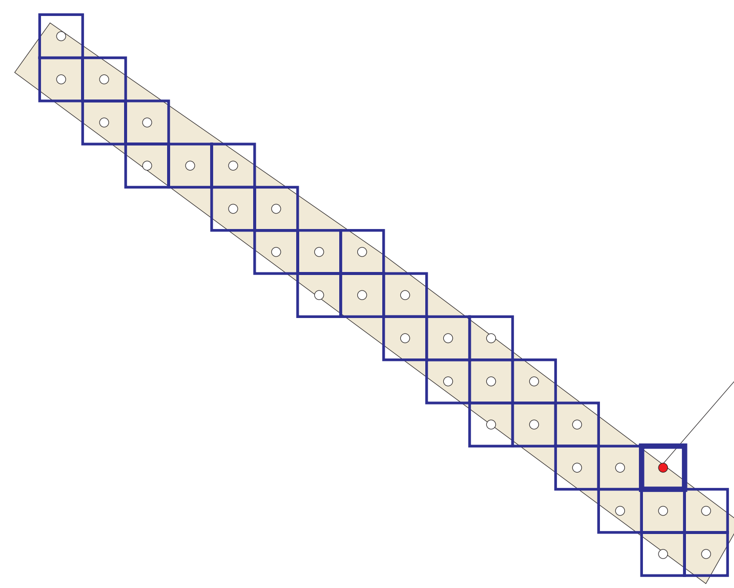


S19630311C	158	1

Benchmark Code*
Benchmark Value

1	MTCA Ecological Indicator (118 mg/Kg)
2	MTCA Unrestricted Land Use (250 mg/Kg)
3	PRG Residential Soil (400 mg/Kg)
4	PRG Industrial Soil (750 mg/Kg)
5	MTCA Industrial Property (1,000 mg/Kg)

Benchmark Code
Lead Results by Method 7420 (mg/Kg)
Sample Number

S19630311C	158	1

* The benchmark code indicates the largest benchmark value surpassed by the lead concentration in the sample.

Figure 5-7

Camp Bonneville

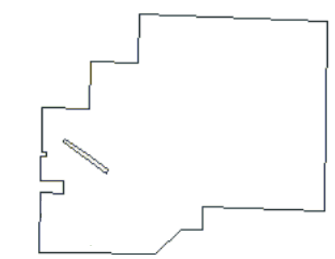
Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

Machine Gun North

Lead Results Greater than Benchmark Values (mg/Kg)

Key Map

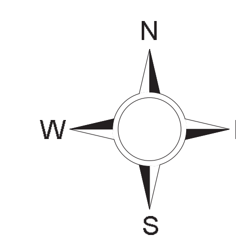


Legend

- **Sampling Grid**
- **Sampling Grid Center Point**
- **Sample Location Surpassing Benchmark Values**

Range Footprint

- **Machine Gun North**



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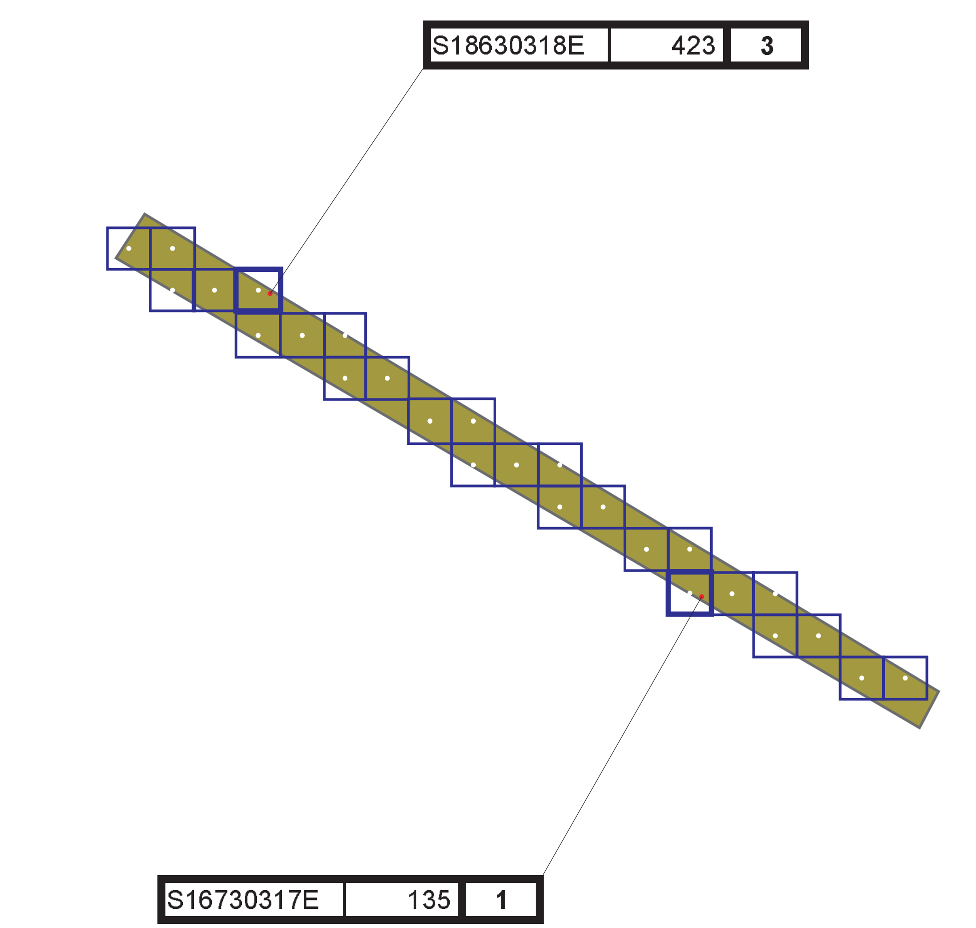
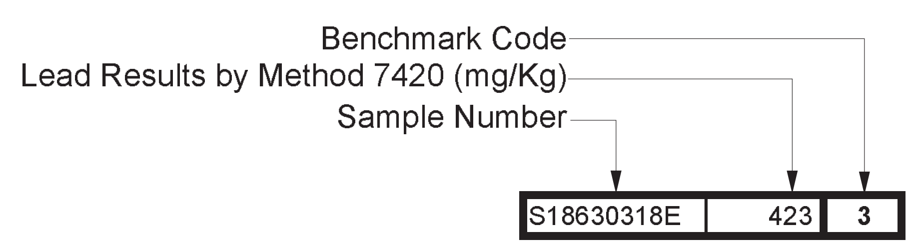




Benchmark Code*
Benchmark Value

1	MTCA Ecological Indicator (118 mg/Kg)
2	MTCA Unrestricted Land Use (250 mg/Kg)
3	PRG Residential Soil (400 mg/Kg)
4	PRG Industrial Soil (750 mg/Kg)
5	MTCA Industrial Property (1,000 mg/Kg)

* The benchmark code indicates the largest benchmark value surpassed by the lead concentration in the sample.

Figure 5-8

Camp Bonneville

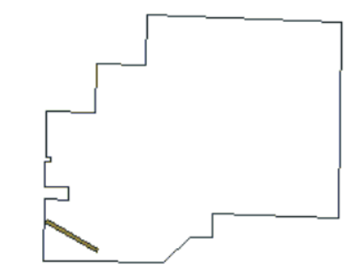
Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Machine Gun South
Lead Results Greater than Benchmark Values (mg/Kg)

Key Map

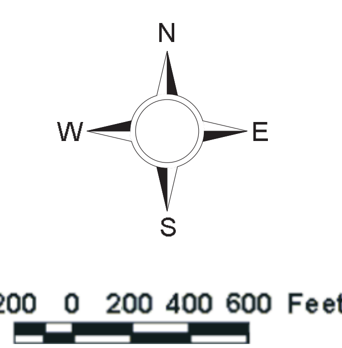


Legend

- Sampling Grid
- Sampling Grid Center Point
- Sample Location Surpassing Benchmark Values

Range Footprint

- Machine Gun South



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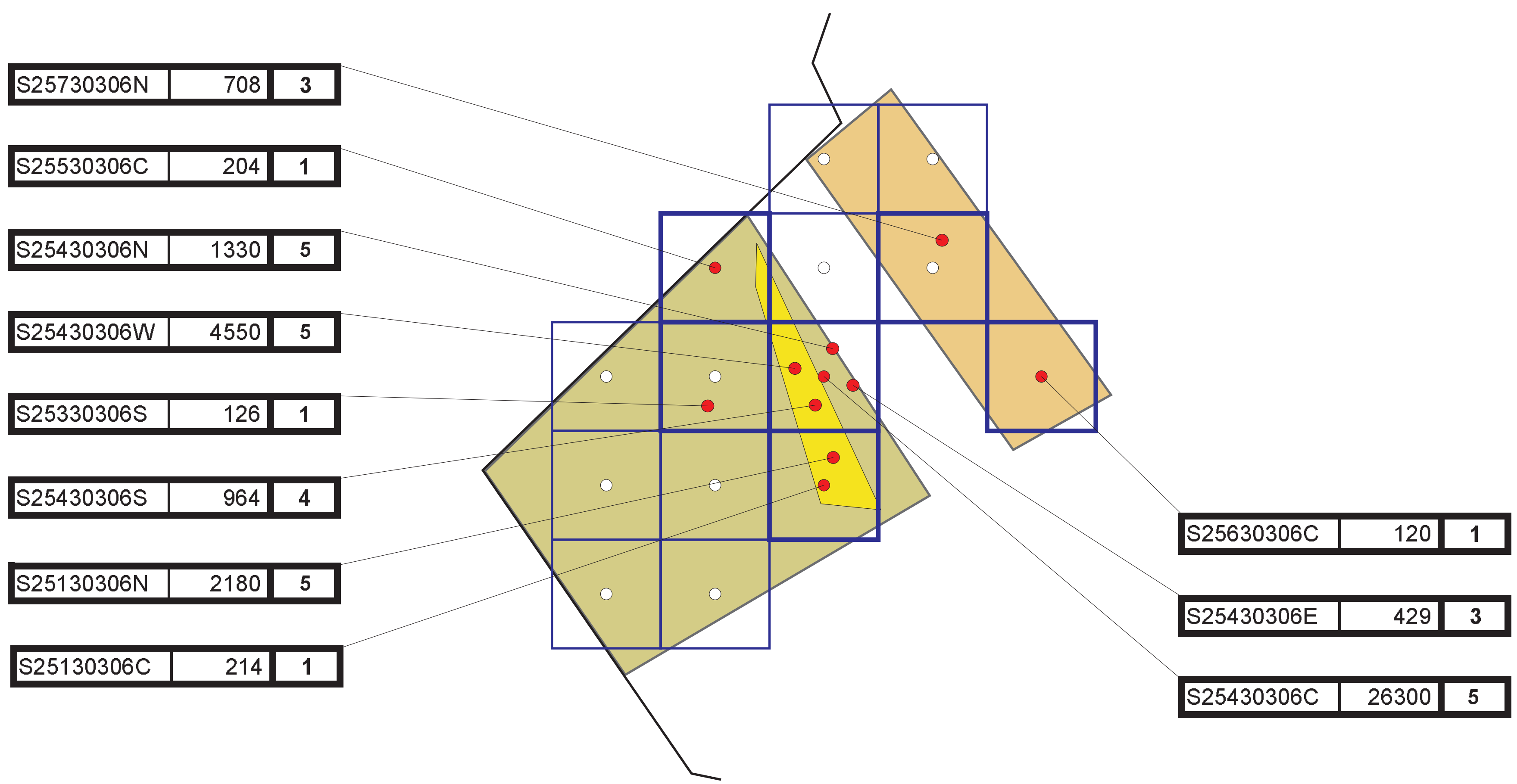


Benchmark Code
Lead Results by Method 7420 (mg/Kg)
Sample Number

Sample Number	Lead Results	Benchmark Code
S25730306N	708	3

Benchmark Code*
Benchmark Value

Benchmark Code	Benchmark Value
1	MTCA Ecological Indicator (118 mg/Kg)
2	MTCA Unrestricted Land Use (250 mg/Kg)
3	PRG Residential Soil (400 mg/Kg)
4	PRG Industrial Soil (750 mg/Kg)
5	MTCA Industrial Property (1,000 mg/Kg)

* The benchmark code indicates the largest benchmark value surpassed by the lead concentration in the sample.

Figure 5-9

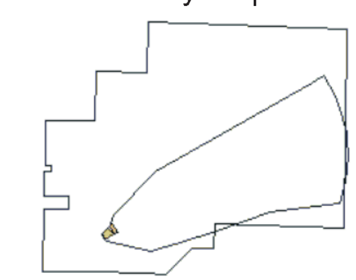
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

25 Meter and Machine Gun Range Lead Results Greater than Benchmark Values (mg/Kg)

Key Map

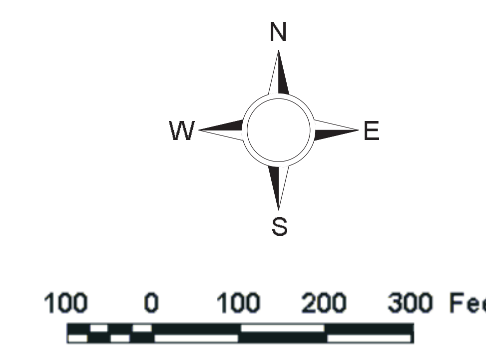


Legend

- Sampling Grid
- Sampling Grid Center Point
- Sample Location Surpassing Benchmark Values
- Range Fan
- Berm

Range Footprint

- 25M Range, Machine Gun Range
- 25M Range, Machine Gun Range (drop zone)



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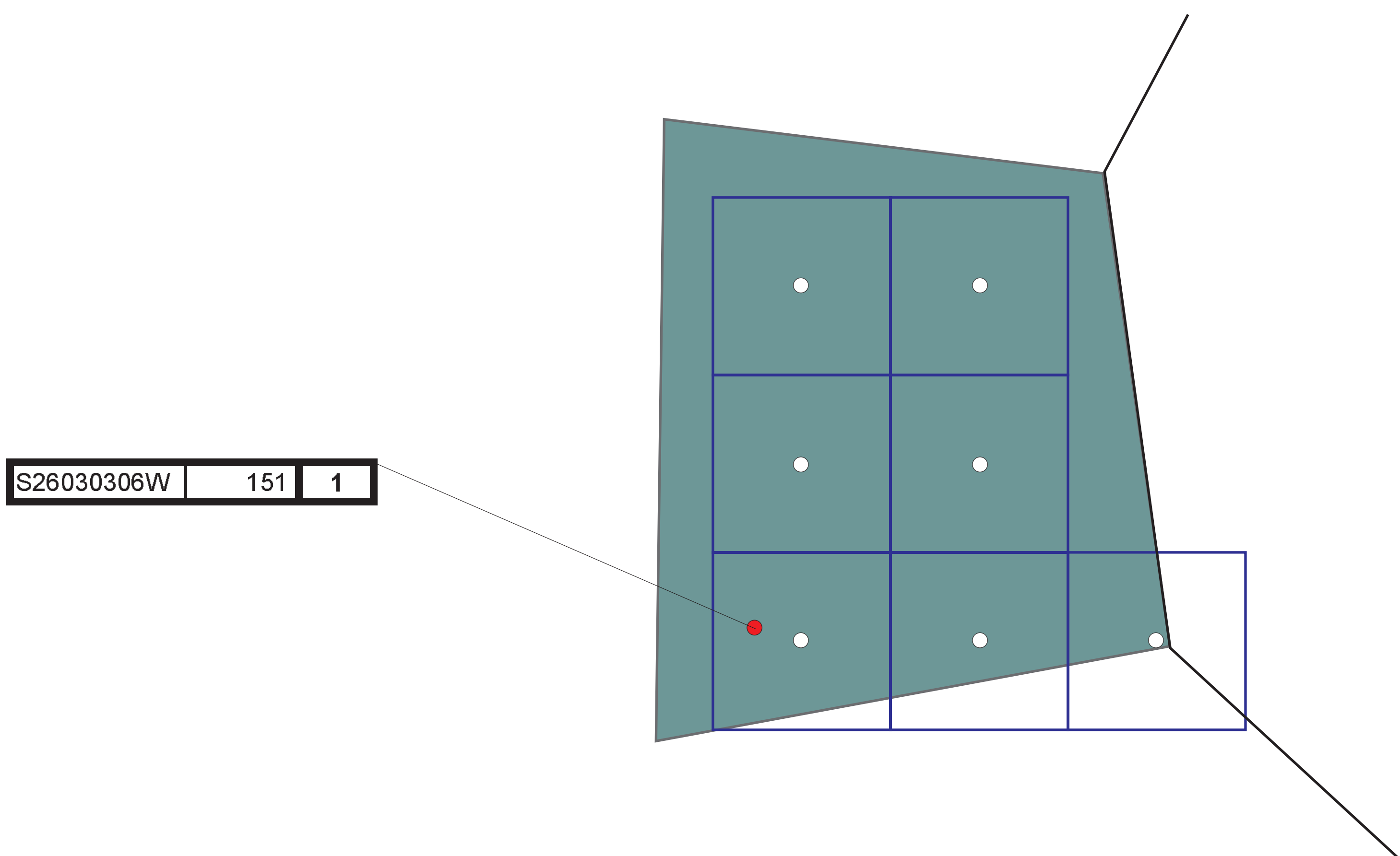


Benchmark Code*
Benchmark Value

1	MTCA Ecological Indicator (118 mg/Kg)
2	MTCA Unrestricted Land Use (250 mg/Kg)
3	PRG Residential Soil (400 mg/Kg)
4	PRG Industrial Soil (750 mg/Kg)
5	MTCA Industrial Property (1,000 mg/Kg)

* The benchmark code indicates the largest benchmark value surpassed by the lead concentration in the sample.

Benchmark Code
Lead Results by Method 7420 (mg/Kg)
Sample Number

Sample Number	Lead Results by Method 7420 (mg/Kg)	Benchmark Code
S11030312E	136	1

Figure 5-10

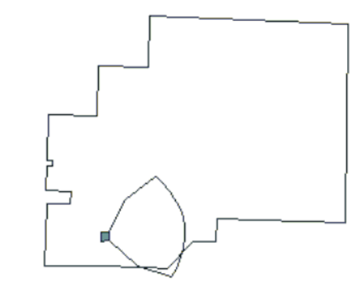
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

Infiltration Course South
Lead Results Greater than Benchmark Values (mg/Kg)

Key Map



Legend

- Sampling Grid
- Sampling Grid Center Point
- Sample Location Surpassing Benchmark Values
- Range Fan

Range Footprint
- Infiltration Course South

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100 0 100 200 Feet

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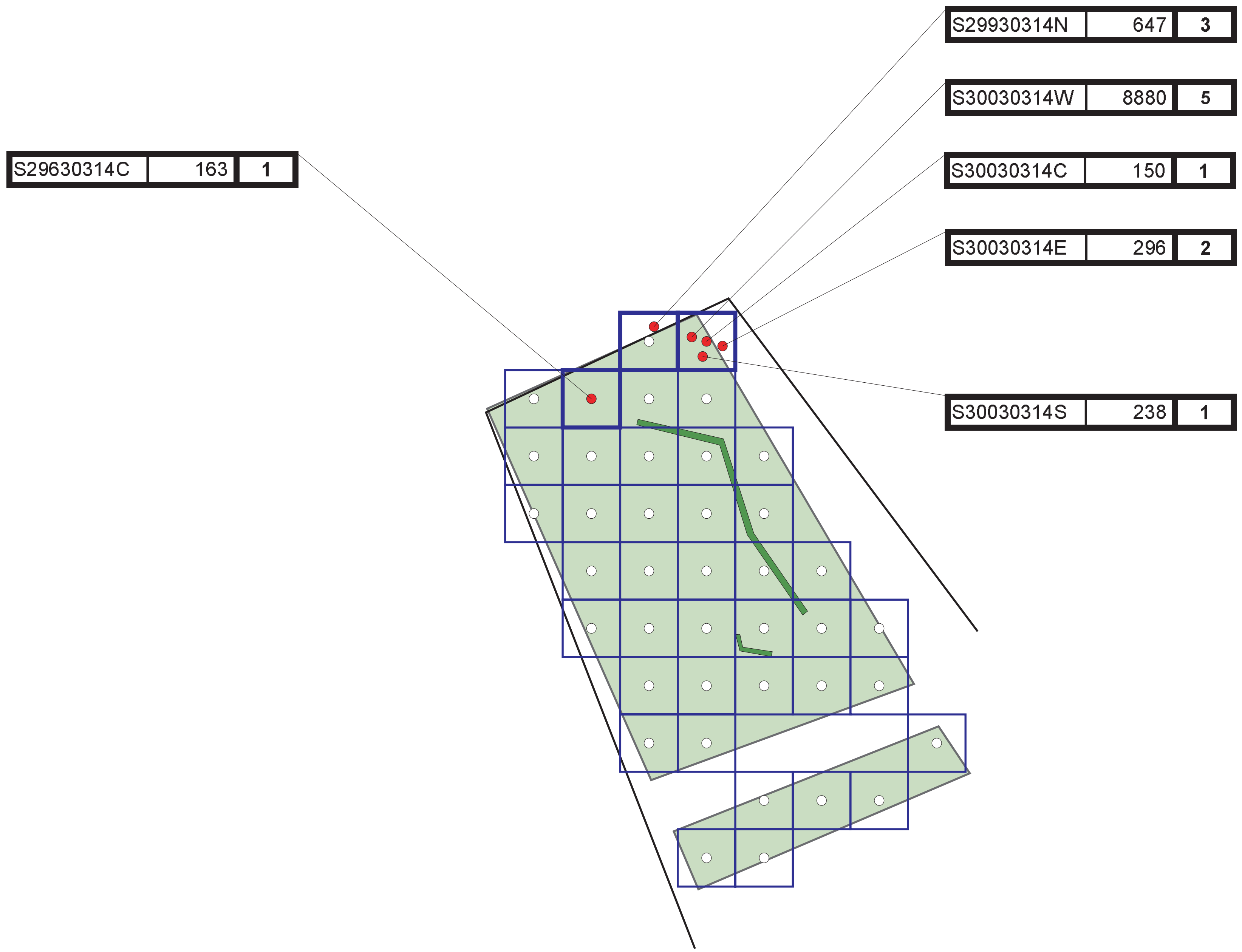


Benchmark Code
Lead Results by Method 7420 (mg/Kg)
Sample Number

Sample Number	Lead Results	Benchmark Code
S30030314S	238	1

Benchmark Code*
Benchmark Value

1	MTCA Ecological Indicator (118 mg/Kg)
2	MTCA Unrestricted Land Use (250 mg/Kg)
3	PRG Residential Soil (400 mg/Kg)
4	PRG Industrial Soil (750 mg/Kg)
5	MTCA Industrial Property (1,000 mg/Kg)

* The benchmark code indicates the largest benchmark value surpassed by the lead concentration in the sample.

Figure 5-11

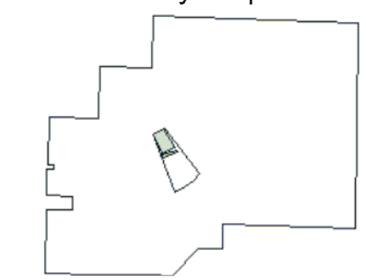
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

25M Record Fire Field Range
Field Firing Range
Lead Results Greater than
Benchmark Values (mg/Kg)

Key Map



Legend

- Sampling Grid
- Sampling Grid Center Point
- Sample Location Surpassing Benchmark Values
- Range Fan
- Berms

Range Footprint
- 25M Record, Fire Field Range, Field Firing Range

N
W E
S

200 0 200 400 600 Feet

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APPENDIX A

Tables of Sampling Results

INDEX TO APPENDIX A

TABLE

INDEX TO APPENDIX A (CONTINUED)

TABLE

Table A-1
Close Combat Range - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)
CLOSE_COMB-1	S00130305C	<5.2	CLOSE_COMB-9	S00930305C	9.8	CLOSE_COMB-17	S01730305C	10.7
	S00130305N	6.2		S00930305N	7.1		S01730305N	23.9
	S00130305S	7.2		S00930305S	10.3		S01730305S	11.7
	S00130305E	10.7		S00930305E	11.6		S01730305E	14.2
	S00130305W	9.0		S00930305W	16.5		S01730305W	14.1
CLOSE_COMB-2	S00230305C	7.5	CLOSE_COMB-10	S01030305C	9.4	CLOSE_COMB-18	S01830305C	14.9
	S00230305N	8.7		S01030305N	10.5		S01830305N	9.4
	S00230305S	7.8		S01030305S	10.5		S01830305S	16.5
	S00230305E	9.2		S01030305E	8.3		S01830305E	15.9
	S00230305W	19		S01030305W	11.6		S01830305W	16.3
CLOSE_COMB-3	S00330304C	16.9	CLOSE_COMB-11	S01130304C	9.2	CLOSE_COMB-19	S01930304C	8.5
	S00330304N	19.8		S01130304N	9.9		S01930304N	< 5
	S00330304S	15		S01130304S	12.8		S01930304S	7.9
	S00330304E	17.2		S01130304E	11.6		S01930304E	7.9
	S00330304W	23.7		S01130304W	8.7		S01930304W	< 5.2
CLOSE_COMB-4	S00430304C	15.7	CLOSE_COMB-12	S01230304C	21.7	CLOSE_COMB-20	S02030304C	14.4
	S00430304N	19.4		S01230304N	10.2		S02030304N	19.2
	S00430304S	16.3		S01230304S	16.3		S02030304S	17.6
	S00430304E	17.7		S01230304E	15.7		S02030304E	18.7
	S00430304W	18		S01230304W	16.4		S02030304W	17.6
CLOSE_COMB-5	S00530305C	10.9	CLOSE_COMB-13	S01330305C	12.1	CLOSE_COMB-21	S02130303C	15.5
	S00530305N	9.0		S01330305N	5.9		S02130303N	12.9
	S00530305S	10.4		S01330305S	< 5.3		S02130303S	12.1
	S00530305E	11.3		S01330305E	16		S02130303E	18.8
	S00530305W	9.8		S01330305W	10.8		S02130303W	19.1
CLOSE_COMB-6	S00630305C	8.9	CLOSE_COMB-14	S01430305C	7.1	CLOSE_COMB-22	S02230303C	21.7
	S00630305N	6.9		S01430305N	88.3		S02230303N	14.5
	S00630305S	9.1		S01430305S	8.3		S02230303S	18.6
	S00630305E	14.6		S01430305E	12.6		S02230303E	22.2
	S00630305W	9.7		S01430305W	10.6		S02230303W	15.1
CLOSE_COMB-7	S00730304C	19.7	CLOSE_COMB-15	S01530304C	9.4	CLOSE_COMB-23	S02330303C	15.4
	S00730304N	16.8		S01530304N	9.4		S02330303N	18.4
	S00730304S	20.4		S01530304S	9.6		S02330303S	16.1
	S00730304E	12.7		S01530304E	7.8		S02330303E	19.8
	S00730304W	9.0		S01530304W	< 5.4		S02330303W	16.7
CLOSE_COMB-8	S00830304C	13.4	CLOSE_COMB-16	S01630304C	12	CLOSE_COMB-24	S02430303C	14
	S00830304N	11.7		S01630304N	16		S02430303N	12.6
	S00830304S	11.1		S01630304S	14.5		S02430303S	17.2
	S00830304E	19.5		S01630304E	16.7		S02430303E	15.3
	S00830304W	12.3		S01630304W	13.7		S02430303W	21.4

Table A-2
25-Meter M60 Range/Pistol Range - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)
25M_M60-1	S02530304C	29.9
	S02530304N	108
	S02530304S	21.9
	S02530304E	64.6
	S02530304W	21.1
25M_M60-2	S02630304C	21.8
	S02630304N	21.1
	S02630304S	22.2
	S02630304E	11.8
	S02630304W	24.8
25M_M60-3	S02730304C	37.2
	S02730304N	136
	S02730304S	34.6
	S02730304E	219
	S02730304W	35.3
25M_M60-4	S02830304C	68.3
	S02830304N	13.8
	S02830304S	44.9
	S02830304E	8.7
	S02830304W	33.7

Table A-3
Sub Machine Gun Range - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)
SUB_MACHINE-1	S02930303C	9.2
	S02930303N	12.5
	S02930303S	12.2
	S02930303E	9.1
	S02930303W	6.8
SUB_MACHINE-2	S03030303C	7.0
	S03030303N	8.9
	S03030303S	18.4
	S03030303E	6.9
	S03030303W	10.0
SUB_MACHINE-3	S03130303C	10.9
	S03130303N	< 4.4
	S03130303S	10.3
	S03130303E	10.9
	S03130303W	10.0
SUB_MACHINE-4	S03230303C	9.2
	S03230303N	10.9
	S03230303S	11.6
	S03230303E	9.0
	S03230303W	6.8
SUB_MACHINE-5	S03330303C	15.4
	S03330303N	7.0
	S03330303S	12.5
	S03330303E	9.4
	S03330303W	11.4
SUB_MACHINE-6	S03430303C	13.1
	S03430303N	10.4
	S03430303S	11.2
	S03430303E	10.3
	S03430303W	10.0
SUB_MACHINE-7	S03530303C	6.3
	S03530303N	8.8
	S03530303S	8.7
	S03530303E	9.3
	S03530303W	9.3

Table A-4
TF Range - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)
TF-1	S03630307C	18.2	TF-5	S04030307C	16.0
	S03630307N	15.4		S04030307N	13.8
	S03630307S	30.2		S04030310S	16.4
	S03630307E	17.5		S04030307E	12.4
	S03630307W	9.4		S04030307W	18.3
TF-2	S03730307C	10.2	TF-6	S04130307C	12.9
	S03730307N	12.5		S04130307N	23.4
	S03730307S	< 5.5		S04130307S	23.4
	S03730307E	10.2		S04130307E	10.6
	S03730307W	9.5		S04130307W	19.6
TF-3	S03830307C	11.5	TF-7	S04230307C	15.2
	S03830310N	20.1		S04230307N	12.2
	S03830307S	11.7		S04230307S	13.7
	S03830307E	12.0		S04230307E	13.7
	S03830307W	10.9		S04230307W	11.7
TF-4	S03930307C	12.3	TF-8	S04330307C	10.9
	S03930307N	11.9		S04330307N	8.7
	S03930307S	18.2		S04330307S	9.3
	S03930307E	14.2		S04330307E	12.9
	S03930307W	12.9		S04330307W	12.4

Table A-5
Rifle Ranges 1 and 2 - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)
RIFLE_RANGE-1	S04430225C	< 10.5	RIFLE_RANGE-8	S05130225C	11.3	RIFLE_RANGE-15	S05830225C	67.0
	S04430225N	< 10.1		S05130225N	25.5		S05830225N	108
	S04430225S	11.4		S05130225S	10.5		S05830225S	25.4
	S04430225E	10.7		S05130225E	52.8		S05830225E	24.6
	S04430225W	11.8		S05130225W	24.2		S05830225W	41.8
RIFLE_RANGE-2	S04530225C	25.9	RIFLE_RANGE-9	S05230225C	37.3	RIFLE_RANGE-16	S05930225C	< 3.9
	S04530225N	19.2		S05230225N	35.4		S05930225N	25.0
	S04530225S	18.4		S05230225S	19.5		S05930225S	12.5
	S04530225E	16.2		S05230225E	51.6		S05930225E	< 3.7
	S04530225W	21.9		S05230225W	18.7		S05930225W	5.8
RIFLE_RANGE-3	S04630225C	17.5	RIFLE_RANGE-10	S05330225C	16.1	RIFLE_RANGE-17	S06030226C	17.0
	S04630225N	17.3		S05330225N	15.5		S06030226N	21.3
	S04630225S	15.5		S05330225S	80.7		S06030226S	19.3
	S04630225E	15.6		S05330225E	13.6		S06030226E	18.9
	S04630225W	6.8		S05330225W	22.7		S06030226W	69.9
RIFLE_RANGE-4	S04730225C	10.7	RIFLE_RANGE-11	S05430225C	15.6	RIFLE_RANGE-18	S06130226C	8.1
	S04730225N	15.6		S05430225N	10.5		S06130226N	11.1
	S04730225S	11.2		S05430225S	49.3		S06130226S	15.1
	S04730225E	13.2		S05430225E	26.0		S06130226E	12.0
	S04730225W	11.2		S05430225W	16.2		S06130226W	< 5.9
RIFLE_RANGE-5	S04830225C	32.9	RIFLE_RANGE-12	S05530225C	16.4	RIFLE_RANGE-19	S06230226C	17.2
	S04830225N	22.5		S05530225N	32.8		S06230226N	52.1
	S04830225S	55.8		S05530225S	15.3		S06230226S	19.2
	S04830225E	34.4		S05530225E	6.9		S06230226E	14.4
	S04830225W	21.3		S05530225W	14.2		S06230226W	14.2
RIFLE_RANGE-6	S04930225C	27.9	RIFLE_RANGE-13	S05630226C	8.7	RIFLE_RANGE-20	S06330226C	12.5
	S04930225N	31.8		S05630226N	5.3		S06330226N	14.2
	S04930225S	17.1		S05630226S	10.3		S06330226S	6.5
	S04930225E	21.6		S05630226E	7.9		S06330226E	6.4
	S04930225W	39.4		S05630226W	14.5		S06330226W	34.8
RIFLE_RANGE-7	S05030225C	17.0	RIFLE_RANGE-14	S05730226C	9.0	RIFLE_RANGE-21	S06430226C	21.1
	S05030225N	24.4		S05730226N	19.3		S06430226N	5.8
	S05030225S	16.3		S05730226S	14.0		S06430226S	17.4
	S05030225E	31.4		S05730226E	18.9		S06430226E	290
	S05030225W	29.6		S05730226W	11.0		S06430226W	14.0

Table A-5
Rifle Ranges 1 and 2 - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)
RIFLE_RANGE-22	S06530226C	< 5.0	RIFLE_RANGE-26	S06930226C	22.4	RIFLE_RANGE-30	S07330226C	273
	S06530226N	17.8		S06930226N	3.6		S07330226N	1690
	S06530226S	4.9		S06930226S	21.2		S07330226S	1750
	S06530226E	6.7		S06930226E	9.5		S07330226E	1850
	S06530226W	5.6		S06930226W	< 4.5		S07330226W	4330
RIFLE_RANGE-23	S06630226C	11.7	RIFLE_RANGE-27	S07030226C	7.4	RIFLE_RANGE-31	S07430226C	199
	S06630226N	11.2		S07030226N	11.3		S07430226N	94.5
	S06630226S	19.1		S07030226S	29.2		S07430226S	96.8
	S06630226E	130		S07030226E	21.6		S07430226E	180
	S06630226W	12.2		S07030226W	8.3		S07430226W	1770
RIFLE_RANGE-24	S06730226C	92.3	RIFLE_RANGE-28	S07130226C	9.3	RIFLE_RANGE-32	S07530226C	82.4
	S06730226N	9.6		S07130226N	87.6		S07530226N	59.1
	S06730226S	36.0		S07130226S	< 4.7		S07530226S	417
	S06730226E	108		S07130226E	95.8		S07530226E	670
	S06730226W	132		S07130226W	5.6		S07530226W	220
RIFLE_RANGE-25	S06830226C	51.3	RIFLE_RANGE-29	S07230226C	65.0			
	S06830226N	145		S07230226N	137			
	S06830226S	212		S07230226S	23.0			
	S06830226E	172		S07230226E	23.0			
	S06830226W	15.2		S07230226W	74.8			

Table A-6
Field Fire Rifle Ranges 1 and 2 - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)
	S07630228C	6.4		S08230228C	18.7		S08830228C	17.1
	S07630228N	< 5		S08230228N	15.2		S08830228N	8.2
FIELD_FIRING_RIFLE-1	S07630228S	7.4	FIELD_FIRING_RIFLE-7	S08230228S	20.8	FIELD_FIRING_RIFLE-13	S08830228S	28.2
	S07630228E	11.2		S08230228E	19.6		S08830228E	5.4
	S07630228W	8.6		S08230228W	12.3		S08830228W	38.8
	S07730301C	23.6		S08330228C	10.7		S08930228C	8
	S07730301N	14.2		S08330228N	11.1		S08930228N	10.8
FIELD_FIRING_RIFLE-2	S07730301S	17.5	FIELD_FIRING_RIFLE-8	S08330228S	11.5	FIELD_FIRING_RIFLE-14	S08930228S	7.9
	S07730301E	23.6		S08330228E	8.9		S08930228E	2300
	S07730301W	7.4		S08330228W	6.1		S08930228W	9.3
	S07830228C	48.8		S08430228C	26.2		S09030228C	8.4
	S07830228N	16.8		S08430228N	19.0		S09030228N	9.1
FIELD_FIRING_RIFLE-3	S07830228S	14.6	FIELD_FIRING_RIFLE-9	S08430228S	5.1	FIELD_FIRING_RIFLE-15	S09030228S	20.6
	S07830228E	13.5		S08430228E	9.4		S09030228E	44.4
	S07830228W	11.2		S08430228W	10.2		S09030228W	7.4
	S07930228C	11.0		S08530228C	< 4.6		S09130228C	59.1
	S07930228N	9.4		S08530228N	10.7		S09130228N	23.1
FIELD_FIRING_RIFLE-4	S07930228S	15.4	FIELD_FIRING_RIFLE-10	S08530228S	6	FIELD_FIRING_RIFLE-16	S09130228S	95.4
	S07930228E	16.2		S08530228E	7.7		S09130228E	17.7
	S07930228W	< 5.2		S08530228W	8.5		S09130228W	8.5
	S08030228C	97		S08630228C	13.4		S09230228C	32.3
	S08030228N	7.4		S08630228N	10.1		S09230228N	< 4.4
FIELD_FIRING_RIFLE-5	S08030228S	23.7	FIELD_FIRING_RIFLE-11	S08630228S	61	FIELD_FIRING_RIFLE-17	S09230228S	37
	S08030228E	69.9		S08630228E	6.9		S09230228E	53.3
	S08030228W	11.2		S08630228W	7.5		S09230228W	69.3
	S08130301C	62.4		S08730228C	6.8		S09330301C	35.6
FIELD_FIRING_RIFLE-6	S08130301N	15.2		S08730228N	11.7		S09330301N	23.6
	S08130301S	7.4	FIELD_FIRING_RIFLE-12	S08730228S	19.1	FIELD_FIRING_RIFLE-18	S09330301S	47.4
	S08130301E	6.1		S08730228E	7.6		S09330301E	22.5
	S08130301W	29.4		S08730228W	18.7		S09330301W	78.5

Table A-6
Field Fire Rifle Ranges 1 and 2 - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)
FIELD_FIRING_RIFLE-19	S09430228C	114
	S09430228N	29.3
	S09430228S	15
	S09430228E	149
	S09430228W	14.9
FIELD_FIRING_RIFLE-20	S09530228C	25.9
	S09530228N	17.7
	S09530228S	9.4
	S09530228E	8.1
	S09530228W	29.8
FIELD_FIRING_RIFLE-21	S09630301C	52.3
	S09630301N	23.8
	S09630301S	13.9
	S09630301E	11.2
	S09630301W	24.7
FIELD_FIRING_RIFLE-22	S09730301C	5.8
	S09730301N	47.3
	S09730301S	8.2
	S09730301E	9
	S09730301W	52.6

Table A-7
Infiltration Course North - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)
INFIL_NORTH-1	S09830301C	15.3
	S09830301N	12.1
	S09830301S	12.1
	S09830301E	21.8
	S09830301W	12.9
INFIL_NORTH-2	S09930301C	4.9
	S09930301N	14.2
	S09930301S	10.2
	S09930301E	44.1
	S09930301W	18.5
INFIL_NORTH-3	S10030301C	22.4
	S10030301N	9.0
	S10030301S	15.4
	S10030301E	10.9
	S10030301W	< 3.7
INFIL_NORTH-4	S10130301C	19.4
	S10130301N	20.1
	S10130301S	< 3.8
	S10130301E	14.3
	S10130301W	24.6

Table A-8
Field Firing Ranges 1 and 2 and Pistol Range - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)
FIELD_FIRING-1	S10230312C	9.6	FIELD_FIRING-8	S10930317C	21
	S10230312N	8.8		S10930317N	16
	S10230312S	11.2		S10930317S	25.9
	S10230312E	9.9		S10930317E	12.7
	S10230312W	10.1		S10930317W	13.5
FIELD_FIRING-2	S10330312C	8.6	FIELD_FIRING-9	S11030312C	13.1
	S10330312N	6.9		S11030312N	11.8
	S10330312S	9.9		S11030312S	17.2
	S10330312E	8.1		S11030312E	136
	S10330312W	13.8		S11030312W	19.6
FIELD_FIRING-3	S10430317C	68.1	FIELD_FIRING-10	S11130312C	13.9
	S10430317N	17.1		S11130312N	13.7
	S10430317S	259		S11130312S	20.3
	S10430317E	154		S11130312E	18.7
	S10430317W	10.4		S11130312W	20.3
FIELD_FIRING-4	S10530312C	11.5	FIELD_FIRING-11	S11230312C	10.6
	S10530312N	11.9		S11230312N	11.7
	S10530312S	15.2		S11230312S	20.4
	S10530312E	13.6		S11230312E	14.8
	S10530312W	13		S11230312W	13.8
FIELD_FIRING-5	S10630312C	8.8	FIELD_FIRING-12	S11330312C	7150
	S10630312N	9.2		S11330312N	125
	S10630312S	13.6		S11330312S	267
	S10630312E	11.7		S11330312E	728
	S10630312W	10.6		S11330312W	187
FIELD_FIRING-6	S10730312C	17.7	FIELD_FIRING-13	S11430312C	15.8
	S10730312N	58.5		S11430312N	49
	S10730312S	9.2		S11430312S	13.1
	S10730312E	13.9		S11430312E	24.6
	S10730312W	11.9		S11430312W	16
FIELD_FIRING-7	S10830312C	9.2	FIELD_FIRING-14	S11530312C	10
	S10830312N	8.1		S11530312N	11.4
	S10830312S	8.2		S11530312S	10.7
	S10830312E	5.8		S11530312E	10.5
	S10830312W	10.7		S11530312W	10.4

Table A-9
1,000-Foot Range, 1,000-Foot Machine Gun Range and Moving Target Range - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)
	S11630314C	6.3		S12330314C	871		S13030310C	9.3
	S11630314N	15.3		S12330314N	55.8		S13030310N	11.9
1000FT-1	S11630314S	< 4.9	1000FT-8	S12330314S	4560	1000FT-15	S13030310S	13.5
	S11630314E	14.5		S12330314E	198		S13030310E	12.2
	S11630314W	16.5		S12330314W	566		S13030310W	17.4
	S11730314C	16.4		S12430314C	16		S13130310C	12.6
	S11730314N	16.6		S12430314N	25.3		S13130310N	22.1
1000FT-2	S11730314S	15.5	1000FT-9	S12430314S	24.8	1000FT-16	S13130310S	14.3
	S11730314E	16.7		S12430314E	14.2		S13130310E	7.4
	S11730314W	13.8		S12430314W	17.4		S13130310W	13.3
	S11830314C	10		S12530314C	15.5		S13230310C	17
	S11830314N	9.3		S12530314N	10		S13230310N	63.3
1000FT-3	S11830314S	22.6	1000FT-10	S12530314S	25	1000FT-17	S13230310S	13.7
	S11830314E	7.8		S12530314E	12.6		S13230310E	9.7
	S11830314W	9.1		S12530314W	11.6		S13230310W	13.6
	S11930314C	3450		S12630314C	< 4.8		S13330310C	7.5
	S11930314N	10200		S12630314N	8.8		S13330310N	14.3
1000FT-4	S11930314S	438	1000FT-11	S12630314S	11.4	1000FT-18	S13330310S	15.2
	S11930314E	49.6		S12630314E	10.9		S13330310E	10.4
	S11930314W	2350		S12630314W	16		S13330310W	11.4
	S12030314C	58		S12730310C	30.1		S13430310C	9.9
	S12030314N	14.8		S12730310N	10.8		S13430310N	22.8
1000FT-5	S12030314S	12.5	1000FT-12	S12730310S	19.6	1000FT-19	S13430310S	15
	S12030314E	12.7		S12730310E	12.4		S13430310E	11.7
	S12030314W	17.2		S12730310W	15.5		S13430310W	6.2
	S12130314C	10.1		S12830310C	32.2		S13530310C	16.6
	S12130314N	11.7		S12830310N	11.5		S13530310N	11.3
1000FT-6	S12130314S	12.3	1000FT-13	S12830310S	19.8	1000FT-20	S13530310S	11.9
	S12130314E	11.5		S12830310E	18.6		S13530310E	12.4
	S12130314W	9.9		S12830310W	39.6		S13530310W	22.9
	S12230314C	21.5		S12930310C	15.3		S13630310C	12.1
	S12230314N	56.7		S12930310N	14.8		S13630310N	10
1000FT-7	S12230314S	4.7	1000FT-14	S12930310S	15.2	1000FT-21	S13630310S	9.4
	S12230314E	63.7		S12930310E	13.1		S13630310E	10.4
	S12230314W	10.1		S12930310W	7.5		S13630310W	13.8

Table A-9
1,000-Foot Range, 1,000-Foot Machine Gun Range and Moving Target Range - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)
1000FT-22	S13730310C	29.8	1000FT-25	S14030310C	10	1000FT-28	S14330310C	334
	S13730310N	39.1		S14030310N	48.3		S14330310N	279
	S13730310S	25.5		S14030310S	13.4		S14330310S	7610
	S13730310E	14.9		S14030310E	13.9		S14330310E	2350
	S13730310W	26.6		S14030310W	28.1		S14330310W	210
1000FT-23	S13830310C	22.8	1000FT-26	S14130310C	63.4	1000FT-29	S14430310C	51.9
	S13830310N	20.6		S14130310N	115		S14430310N	15.1
	S13830310S	15.2		S14130310S	98.4		S14430310S	19.2
	S13830310E	45		S14130310E	282		S14430310E	216
	S13830310W	20.1		S14130310W	172		S14430310W	109
1000FT-24	S13930310C	90.7	1000FT-27	S14230310C	241	1000FT-30	S14530310C	120
	S13930310N	128		S14230310N	91.7		S14530310N	115
	S13930310S	28.2		S14230310S	346		S14530310S	96.4
	S13930310E	21.2		S14230310E	68.5		S14530310E	170
	S13930310W	146		S14230310W	136		S14530310W	106

Table A-10
Combat Pistol Range - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)
COMB_PISTOL-1	S14630313C	17.2
	S14630313N	15.5
	S14630313S	23.3
	S14630313E	16.7
	S14630313W	33.3
COMB_PISTOL-2	S14730312C	16.0
	S14730312N	39.5
	S14730312S	16.3
	S14730312E	24.1
	S14730312W	31.7
COMB_PISTOL-3	S14830313C	16.2
	S14830313N	15.9
	S14830313S	15.7
	S14830313E	43
	S14830313W	15.9
COMB_PISTOL-4	S14930312C	29.6
	S14930312N	15.5
	S14930312S	81.8
	S14930312E	165
	S14930312W	58.5
COMB_PISTOL-5	S15030313C	46.1
	S15030313N	17.2
	S15030313S	16.8
	S15030313E	29.5
	S15030313W	33.1
COMB_PISTOL-6	S15130312C	14.4
	S15130312N	14.9
	S15130312S	23.2
	S15130312E	13.4
	S15130312W	22.9
COMB_PISTOL-7	S15230312C	19.8
	S15230312N	14.2
	S15230312S	27.6
	S15230312E	20.3
	S15230312W	12.5
COMB_PISTOL-8	S15330313C	12
	S15330313N	12.6
	S15330313S	10.1
	S15330313E	12.7
	S15330313W	11.2
COMB_PISTOL-9	S15430313C	11
	S15430313N	17.7
	S15430313S	10.2
	S15430313E	12.3
	S15430313W	8.7
COMB_PISTOL-10	S15530313C	16.4
	S15530313N	12.2
	S15530313S	20.5
	S15530313E	13.5
	S15530313W	15.3
COMB_PISTOL-11	S15630313C	13.1
	S15630313N	14.3
	S15630313S	15.2
	S15630313E	14.1
	S15630313W	15.9
COMB_PISTOL-12	S15730313C	23.8
	S15730313N	27.6
	S15730313S	14.4
	S15730313E	20.5
	S15730313W	35.5
COMB_PISTOL-13	S15830313C	21.4
	S15830313N	25.3
	S15830313S	24.2
	S15830313E	35.5
	S15830313W	116
COMB_PISTOL-14	S15930313C	18.1
	S15930313N	54
	S15930313S	22.2
	S15930313E	16.9
	S15930313W	11.3
COMB_PISTOL-15	S16030313C	11.5
	S16030313N	12
	S16030313S	19.5
	S16030313E	17
	S16030313W	785
COMB_PISTOL-16	S16130313C	11.5
	S16130313N	39.3
	S16130313S	9.5
	S16130313E	11.4
	S16130313W	11.3
COMB_PISTOL-17	S16230313C	12.3
	S16230313N	9.2
	S16230313S	12.2
	S16230313E	9.3
	S16230313W	12.8

Table A-11
Machine Gun Range (South) - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)
MG_NORTH-1	S16330317C	8	MG_NORTH-7	S16930317C	8.9	MG_NORTH-13	S17530318C	18.1
	S16330317N	19.5		S16930317N	9.9		S17530318N	12.7
	S16330317S	8		S16930317S	14		S17530318S	12.9
	S16330317E	8.8		S16930317E	10.3		S17530318E	12.1
	S16330317W	8.5		S16930317W	22		S17530318W	11.8
MG_NORTH-2	S16430317C	21.2	MG_NORTH-8	S17030318C	16.3	MG_NORTH-14	S17630318C	10.3
	S16430317N	12		S17030318N	12.9		S17630318N	12
	S16430317S	14.5		S17030318S	12.4		S17630318S	10.3
	S16430317E	13.1		S17030318E	14.9		S17630318E	11.7
	S16430317W	10.7		S17030318W	19.1		S17630318W	12
MG_NORTH-3	S16530317C	14.4	MG_NORTH-9	S17130318C	12.9	MG_NORTH-15	S17730318C	11.5
	S16530317N	10.7		S17130318N	12.9		S17730318N	11.5
	S16530317S	17.7		S17130318S	16.9		S17730318S	10.0
	S16530317E	13.5		S17130318E	14.9		S17730318E	11.5
	S16530317W	14.2		S17130318W	13.6		S17730318W	10.7
MG_NORTH-4	S16630317C	6.9	MG_NORTH-10	S17230318C	11.4	MG_NORTH-16	S17830318C	10.6
	S16630317N	9.8		S17230318N	11.4		S17830318N	9.1
	S16630317S	12.9		S17230318S	10.6		S17830318S	5.2
	S16630317E	7.4		S17230318E	11.9		S17830318E	6.9
	S16630317W	6.9		S17230318W	12		S17830318W	14.5
MG_NORTH-5	S16730317C	21.8	MG_NORTH-11	S17330318C	10.9	MG_NORTH-17	S17930318C	13.4
	S16730317N	12.3		S17330318N	14.6		S17930318N	9.8
	S16730317S	17.2		S17330318S	11.9		S17930318S	12.1
	S16730317E	135		S17330318E	9.8		S17930318E	14.5
	S16730317W	16.1		S17330318W	7.7		S17930318W	18.6
MG_NORTH-6	S16830317C	24.1	MG_NORTH-12	S17430318C	10.7	MG_NORTH-18	S18030318C	13.1
	S16830317N	16.5		S17430318N	14.4		S18030318N	14.3
	S16830317S	31.5		S17430318S	28.8		S18030318S	17.8
	S16830317E	27		S17430318E	19.2		S18030318E	15
	S16830317W	18.8		S17430318W	10.3		S18030318W	21.1

Table A-11
Machine Gun Range (South) - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)
MG_NORTH-19	S18130318C	13.1	MG_NORTH-22	S18430318C	19.5	MG_NORTH-25	S18730318C	13.4
	S18130318N	27.8		S18430318N	15.2		S18730318N	18.9
	S18130318S	15.6		S18430318S	24.1		S18730318S	18.5
	S18130318E	12.7		S18430318E	20.4		S18730318E	19.9
	S18130318W	15.9		S18430318W	13.1		S18730318W	16.4
MG_NORTH-20	S18230318C	13.1	MG_NORTH-23	S18530318C	20.9	MG_NORTH-26	S18830318C	19
	S18230318N	14.1		S18530318N	18.2		S18830318N	19.6
	S18230318S	11.6		S18530318S	15		S18830318S	13.5
	S18230318E	16.9		S18530318E	14.2		S18830318E	16.4
	S18230318W	20.9		S18530318W	14		S18830318W	14.8
MG_NORTH-21	S18330318C	17	MG_NORTH-24	S18630318C	20.1			
	S18330318N	81		S18630318N	14.6			
	S18330318S	18.1		S18630318S	18.1			
	S18330318E	13.8		S18630318E	423			
	S18330318W	18.8		S18630318W	19.4			

Table A-12
Machine Gun Range (North) - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)
MG_SOUTH-1	S18930311C	63.4	MG_SOUTH-8	S19630311C	158	MG_SOUTH-15	S20330307C	16.5
	S18930311N	37.8		S19630311N	31.8		S20330307N	20
	S18930311S	26.5		S19630311S	14.4		S20330307S	12.3
	S18930311E	59.1		S19630311E	18.7		S20330307E	30.3
	S18930311W	26.6		S19630311W	50.2		S20330307W	15.3
MG_SOUTH-2	S19030311C	25.5	MG_SOUTH-9	S19730311C	6.7	MG_SOUTH-16	S20430307C	12.9
	S19030311N	20.2		S19730311N	10.4		S20430307N	22.9
	S19030311S	18.1		S19730311S	12.9		S20430307S	12.1
	S19030311E	22.7		S19730311E	6.1		S20430307E	10.3
	S19030311W	18.8		S19730311W	18.7		S20430307W	16.1
MG_SOUTH-3	S19130311C	54.7	MG_SOUTH-10	S19830307C	13.9	MG_SOUTH-17	S20530311C	13.4
	S19130311N	25.7		S19830307N	12.5		S20530311N	7.6
	S19130311S	19.3		S19830307S	10.2		S20530311S	62.8
	S19130311E	17.8		S19830307E	10.8		S20530311E	19.5
	S19130311W	17.8		S19830307W	27.5		S20530311W	52.2
MG_SOUTH-4	S19230311C	14.4	MG_SOUTH-11	S19930307C	17.5	MG_SOUTH-18	S20630311C	19.6
	S19230311N	23.3		S19930307N	24.4		S20630311N	26.7
	S19230311S	14.2		S19930307S	18.4		S20630311S	17.8
	S19230311E	15.5		S19930307E	17.8		S20630311E	20
	S19230311W	25.9		S19930307W	13.7		S20630311W	18.9
MG_SOUTH-5	S19330311C	11.9	MG_SOUTH-12	S20030307C	14.2	MG_SOUTH-19	S20730311C	15.9
	S19330311N	17.1		S20030307N	12.2		S20730311N	13.4
	S19330311S	16.8		S20030307S	10.5		S20730311S	22.5
	S19330311E	20.7		S20030307E	13.2		S20730311E	34.9
	S19330311W	22.1		S20030307W	15.6		S20730311W	22
MG_SOUTH-6	S19430307C	16.1	MG_SOUTH-13	S20130307C	23	MG_SOUTH-20	S20830307C	13.2
	S19430307N	21.5		S20130307N	13.6		S20830307N	12.8
	S19430307S	11.5		S20130307S	9.6		S20830307S	12
	S19430307E	24.6		S20130307E	7		S20830307E	12
	S19430307W	14.7		S20130307W	< 5.7		S20830307W	11.7
MG_SOUTH-7	S19530307C	18	MG_SOUTH-14	S20230307C	13.8	MG_SOUTH-21	S20930311C	22.8
	S19530307N	44.6		S20230307N	10.4		S20930311N	23.6
	S19530307S	31		S20230307S	11.6		S20930311S	23.6
	S19530307E	13.6		S20230307E	20.8		S20930311E	14.1
	S19530307W	25.9		S20230307W	11.9		S20930311W	22.5

Table A-12
Machine Gun Range (North) - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)
MG_SOUTH-22	S21030311C	18.8	MG_SOUTH-26	S21430311C	18.8	MG_SOUTH-30	S21830311C	15.1
	S21030311N	17.5		S21430311N	17.5		S21830311N	25.2
	S21030311S	20.5		S21430311S	20.5		S21830311S	26.4
	S21030311E	21		S21430311E	21		S21830311E	23.6
	S21030311W	17.6		S21430311W	17.6		S21830311W	15.6
MG_SOUTH-23	S21130311C	15.3	MG_SOUTH-27	S21530311C	15.3	MG_SOUTH-31	S21930311C	38.3
	S21130311N	23.2		S21530311N	23.2		S21930311N	30.5
	S21130311S	13.5		S21530311S	13.5		S21930311S	107
	S21130311E	19.8		S21530311E	19.8		S21930311E	39.2
	S21130311W	16.6		S21530311W	16.6		S21930311W	53.2
MG_SOUTH-24	S21230311C	21.2	MG_SOUTH-28	S21630311C	21.2	MG_SOUTH-32	S22030311C	39.6
	S21230311N	20.8		S21630311N	20.8		S22030311N	19.6
	S21230311S	20.1		S21630311S	20.1		S22030311S	42.4
	S21230311E	22.9		S21630311E	22.9		S22030311E	21.2
	S21230311W	15.7		S21630311W	15.7		S22030311W	40.9
MG_SOUTH-25	S21330311C	19.8	MG_SOUTH-29	S21730311C	19.8	MG_SOUTH-33	S22130311C	72.8
	S21330311N	16		S21730311N	16		S22130311N	36.4
	S21330311S	18.1		S21730311S	18.1		S22130311S	22
	S21330311E	19		S21730311E	19		S22130311E	38.3
	S21330311W	23.7		S21730311W	23.7		S22130311W	86.2

Table A-13
M31 Sub-Caliber Ranges 1 and 2 - Lead Samples

Sample Point ID	Sample Number	Lead (mg/kg)	Sample Point ID	Sample Number	Lead (mg/kg)	Sample Point ID	Sample Number	Lead (mg/kg)
SUB_CAL-1	S22230319C	11.6	SUB_CAL-7	S22830320C	11.9	SUB_CAL-13	S23430319C	12.4
	S22230319N	14.1		S22830320N	12.3		S23430319N	15.4
	S22230319S	8.4		S22830320S	11.6		S23430319S	17.7
	S22230319E	10.3		S22830320E	11.3		S23430319E	14.3
	S22230319W	20.5		S22830320W	10		S23430319W	14.5
SUB_CAL-2	S22330319C	18.3	SUB_CAL-8	S22930320C	10.1	SUB_CAL-14	S23530320C	10.3
	S22330319N	8.5		S22930320N	12.7		S23530320N	13.3
	S22330319S	9.5		S22930320S	18.2		S23530320S	9.1
	S22330319E	8.1		S22930320E	16.6		S23530320E	< 5
	S22330319W	5.5		S22930320W	14.2		S23530320W	9.6
SUB_CAL-3	S22430319C	11.9	SUB_CAL-9	S23030320C	16.2	SUB_CAL-15	S23630319C	20.5
	S22430319N	12.4		S23030320N	11.1		S23630319N	11.2
	S22430319S	14.1		S23030320S	13.3		S23630319S	14.6
	S22430319E	51.3		S23030320E	10.3		S23630319E	11.5
	S22430319W	12.8		S23030320W	8.2		S23630319W	14.0
SUB_CAL-4	S22530319C	17	SUB_CAL-10	S23130320C	12.5	SUB_CAL-16	S23730319C	< 5.4
	S22530319N	14.5		S23130320N	12		S23730319N	12.1
	S22530319S	10.1		S23130320S	11.6		S23730319S	< 4.9
	S22530319E	15.5		S23130320E	11.3		S23730319E	18.5
	S22530319W	9.5		S23130320W	10.5		S23730319W	< 5.9
SUB_CAL-5	S22630319C	18.9	SUB_CAL-11	S23230320C	12.5	SUB_CAL-17	S23830319C	11.5
	S22630319N	15.5		S23230320N	11.2		S23830319N	12.4
	S22630319S	13.8		S23230320S	12.6		S23830319S	10.3
	S22630319E	16.8		S23230320E	12.1		S23830319E	12.6
	S22630319W	17.8		S23230320W	8.8		S23830319W	10.2
SUB_CAL-6	S22730319C	11.9	SUB_CAL-12	S23330320C	11.3	SUB_CAL-18	S23930319C	11
	S22730319N	11.2		S23330320N	6.6		S23930319N	13.6
	S22730319S	7.8		S23330320S	16.6		S23930319S	9.9
	S22730319E	11.7		S23330320E	20.3		S23930319E	12.1
	S22730319W	8.8		S23330320W	< 4.7		S23930319W	10.9

Table A-13
M31 Sub-Caliber Ranges 1 and 2 - Lead Samples

Sample Point ID	Sample Number	Lead (mg/kg)	Sample Point ID	Sample Number	Lead (mg/kg)	Sample Point ID	Sample Number	Lead (mg/kg)
SUB_CAL-19	S24030319C	10.4	SUB_CAL-22	S24330319C	7.5	SUB_CAL-24	S24530319C	7.5
	S24030319N	5.4		S24330319N	10.7		S24530319N	7.9
	S24030319S	8.8		S24330319S	11.4		S24530319S	10.7
	S24030319E	8.0		S24330319E	< 5.2		S24530319E	11.4
	S24030319W	8.9		S24330319W	10.3		S24530319W	11.9
SUB_CAL-20	S24130319C	9.9	SUB_CAL-23	S24430319C	11.9	SUB_CAL-25	S24630318C	15.4
	S24130319N	8.1		S24430319N	13.6		S24630318N	10.5
	S24130319S	9.1		S24430319S	13.8		S24630318S	8.2
	S24130319E	13		S24430319E	13.3		S24630318E	16.9
	S24130319W	8		S24430319W	13.5		S24630318W	8.9
SUB_CAL-21	S24230319C	9.7						
	S24230319N	13.8						
	S24230319S	15.1						
	S24230319E	11.3						
	S24230319W	8.5						

Table A-14
25-Meter and Machine Gun Range - Lead Samples

Sample Point ID	Sample Number	Lead (mg/kg)
25M_MG-1	S24730306C	12
	S24730306N	10.9
	S24730306S	13.7
	S24730306E	14.6
	S24730306W	116
25M_MG-2	S24830306C	16.2
	S24830306N	19
	S24830306S	43.6
	S24830306E	22.7
	S24830306W	9.6
25M_MG-3	S24930306C	31.1
	S24930306N	19.1
	S24930306S	29.3
	S24930306E	17.2
	S24930306W	18.2
25M_MG-4	S25030306C	27.0
	S25030306N	17.2
	S25030306S	25.2
	S25030306E	31.7
	S25030306W	12.2
25M_MG-5	S25130306C	214
	S25130306N	2180
	S25130306S	49.1
	S25130306E	61
	S25130306W	66.6
25M_MG-6	S25230306C	85.9
	S25230306N	42.7
	S25230306S	25.1
	S25230306E	28.5
	S25230306W	37.6
25M_MG-7	S25330306C	45.4
	S25330306N	31.6
	S25330306S	126
	S25330306E	5.7
	S25330306W	11.4
25M_MG-8	S25430306C	26300
	S25430306N	1330
	S25430306S	964
	S25430306E	429
	S25430306W	4550
25M_MG-9	S25530306C	204
	S25530306N	64.3
	S25530306S	62.1
	S25530306E	24.7
	S25530306W	10.8
25M_MG-10	S25630306C	120
	S25630306N	75.3
	S25630306S	40.4
	S25630306E	105
	S25630306W	64
25M_MG-11	S25730306C	38.2
	S25730306N	708
	S25730306S	13.0
	S25730306E	37.6
	S25730306W	114
25M_MG-12	S25830306C	13.8
	S25830306N	10.6
	S25830306S	25
	S25830306E	6.1
	S25830306W	9.8
25M_MG-13	S25930306C	7.6
	S25930306N	25.5
	S25930306S	33.8
	S25930306E	11
	S25930306W	5.5

Table A-15
Infiltration Course South - Lead Samples

Sample Point ID	Sample Number	Lead (mg/kg)
INFIL_SOUTH-1	S26030306C	14.7
	S26030306N	16.1
	S26030306S	15.8
	S26030306E	11.1
	S26030306W	151
INFIL_SOUTH-2	S26130306C	23.6
	S26130306N	17.5
	S26130306S	15.6
	S26130306E	14.6
	S26130306W	14.5
INFIL_SOUTH-3	S26230306C	15.4
	S26230306N	47.6
	S26230306S	18.2
	S26230306E	11.0
	S26230306W	16.1
INFIL_SOUTH-4	S26330306C	5.6
	S26330306N	9.4
	S26330306S	10.4
	S26330306E	105
	S26330306W	17.9
INFIL_SOUTH-5	S26430306C	10.0
	S26430306N	12.9
	S26430306S	19.1
	S26430306E	10.5
	S26430306W	10.0
INFIL_SOUTH-6	S26530306C	14.1
	S26530306N	13.4
	S26530306S	13.8
	S26530306E	14.8
	S26530306W	13.4
INFIL_SOUTH-7	S26630306C	17.1
	S26630306N	15.9
	S26630306S	23.9
	S26630306E	20.7
	S26630306W	15.7

Table A-16
25M Record Fire Field Range, Field Firing Range - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)
25M_RECORD-1	S26730317C	11.9	25M_RECORD-8	S27430315C	14.3	25M_RECORD-15	S28130315C	13.8
	S26730317N	8.3		S27430315N	9.1		S28130315N	19.9
	S26730317S	9.7		S27430315S	19.3		S28130315S	15.7
	S26730317E	8.9		S27430315E	12.9		S28130315E	10.3
	S26730317W	7.7		S27430315W	9.3		S28130315W	13.8
25M_RECORD-2	S26830317C	11.8	25M_RECORD-9	S27530315C	9.6	25M_RECORD-16	S28230315C	5.9
	S26830317N	7.7		S27530315N	6.6		S28230315N	12.4
	S26830317S	9.1		S27530315S	13.9		S28230315S	9.3
	S26830317E	11		S27530315E	55.2		S28230315E	6.7
	S26830317W	8.8		S27530315W	11.2		S28230315W	5.4
25M_RECORD-3	S26930317C	7.6	25M_RECORD-10	S27630315C	8.8	25M_RECORD-17	S28330315C	12.7
	S26930317N	13.2		S27630315N	12		S28330315N	12.5
	S26930317S	10.3		S27630315S	8.8		S28330315S	11.7
	S26930317E	10.5		S27630315E	8.5		S28330315E	9
	S26930317W	8.2		S27630315W	9.8		S28330315W	11.4
25M_RECORD-4	S27030317C	14.2	25M_RECORD-11	S27730315C	20.8	25M_RECORD-18	S28430315C	11.8
	S27030317N	10.2		S27730315N	11.3		S28430315N	12
	S27030317S	12.2		S27730315S	9		S28430315S	9.3
	S27030317E	8.7		S27730315E	6.8		S28430315E	8.9
	S27030317W	10.5		S27730315W	8		S28430315W	10.9
25M_RECORD-5	S27130317C	12.9	25M_RECORD-12	S27830315C	< 4.8	25M_RECORD-19	S28530315C	13.2
	S27130317N	21		S27830315N	10.6		S28530315N	77.5
	S27130317S	15.9		S27830315S	10.4		S28530315S	44.9
	S27130317E	11.9		S27830315E	25.3		S28530315E	90.3
	S27130317W	7.4		S27830315W	< 5.2		S28530315W	84.5
25M_RECORD-6	S27230317C	8.1	25M_RECORD-13	S27930315C	12.1	25M_RECORD-20	S28630315C	13.6
	S27230317N	12.7		S27930315N	7.6		S28630315N	22.7
	S27230317S	10.4		S27930315S	21.5		S28630315S	17.5
	S27230317E	10.9		S27930315E	12.1		S28630315E	31.7
	S27230317W	11.5		S27930315W	12.4		S28630315W	25.9
25M_RECORD-7	S27330317C	13	25M_RECORD-14	S28030315C	11.9	25M_RECORD-21	S28730315C	18.2
	S27330317N	9.5		S28030315N	15.2		S28730315N	18.6
	S27330317S	10.5		S28030315S	22.9		S28730315S	10
	S27330317E	9.3		S28030315E	11.5		S28730315E	12.9
	S27330317W	10.5		S28020315W	#N/A		S28730315W	23.6

Table A-16
25M Record Fire Field Range, Field Firing Range - Lead Samples

Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)	Sample Point ID	Sample Number	Lead (mg/Kg)
25M_RECORD-22	S28830315C	11.5	25M_RECORD-29	S29530314C	21.0	25M_RECORD-35	S30130317C	12.9
	S28830315N	13.2		S29530314N	18.5		S30130317N	12.3
	S28830315S	12.0		S29530314S	26.0		S30130317S	16.3
	S28830315E	15.2		S29530314E	32.8		S30130317E	13.7
	S28830315W	12.3		S29530314W	11.4		S30130317W	8.5
25M_RECORD-23	S28930315C	11	25M_RECORD-30	S29630314C	163	25M_RECORD-36	S30230317C	8
	S28930315N	11.6		S29630314N	76.5		S30230317N	10
	S28930315S	14		S29630314S	27.3		S30230317S	12.9
	S28930315E	13.6		S29630314E	33.9		S30230317E	12.6
	S28930315W	10.7		S29630314W	51		S30230317W	8.7
25M_RECORD-24	S29030315C	26.3	25M_RECORD-31	S29730314C	31.7	25M_RECORD-37	S30330317C	12.8
	S29030315N	23.2		S29730314N	24.8		S30330317N	12.6
	S29030315S	22.8		S29730314S	30.6		S30330317S	7.5
	S29030315E	13.5		S29730314E	23		S30330317E	10.3
	S29030315W	88.2		S29730314W	19.5		S30330317W	10.2
25M_RECORD-25	S29130315C	44.3	25M_RECORD-32	S29830314C	10.5	25M_RECORD-38	S30430317C	8.7
	S29130315N	14.1		S29830314N	20.5		S30430317N	7.2
	S29130315S	24.3		S29830314S	16.2		S30430317S	7.2
	S29130315E	25.5		S29830314E	13.6		S30430317E	19
	S29130315W	33.7		S29830314W	23.8		S30430317W	8.5
25M_RECORD-26	S29230315C	9.7	25M_RECORD-33	S29930314C	94.9	25M_RECORD-39	S30530317C	12.8
	S29230315N	14.4		S29930314N	647		S30530317N	10.1
	S29230315S	78.4		S29930314S	34.6		S30530317S	10.9
	S29230315E	18.5		S29930314E	19.9		S30530317E	11.6
	S29230315W	13.2		S29930314W	107		S30530317W	41.5
25M_RECORD-27	S29330315C	10.7	25M_RECORD-34	S30030314C	150	25M_RECORD-40	S30630317C	8.5
	S29330315N	14.1		S30030314N	45.3		S30630317N	9.9
	S29330315S	14.8		S30030314S	238		S30630317S	7.4
	S29330315E	11.9		S30030314E	296		S30630317E	9.1
	S29330315W	9.7		S30030314W	8880		S30630317W	11.1
25M_RECORD-28	S29430315C	11.2						
	S29430315N	19.2						
	S29430315S	13.8						
	S29430315E	11.5						
	S29430315W	12.5						

Table A-17
Undocumented Pistol Range - Lead Samples

Sample Point ID	Sample Number	Lead (mg/kg)
UNDOC-PISTOL-1	S30730301C	34.6
	S30730301N	86
	S30730301S	27
	S30730301E	154
	S30730301W	22.6

Table A-17
Undocumented Pistol Range - Lead Samples

Sample Point ID	Sample Number	Lead (mg/kg)
UNDOC-PISTOL-1	S30730301C	34.6
	S30730301N	86
	S30730301S	27
	S30730301E	154
	S30730301W	22.6

Table A-18
Background Samples - Lead

Sample Number	Lead (mg/kg)
S50130224C	< 10.2
S50230304C	14.5
S50330303C	11.5
S50430224C	23.1
S50530224C	70.0
S50630320C	12.4
S50730320C	12.3
S50830310C	69.4
S50930320C	12.3
S51030320C	12.4
S51130320C	13.9
S51230303C	14.8
S51330303C	21.9
S51430303C	9.7
S51530303C	20.5
S51630320C	16.4
S51730320C	26.2
S51830224C	24.7
S51930224C	14.5
S52030314C	80.8

Table A-19
Randomly Selected Firing Range Grid and Background Samples
Priority Pollutant Metals by Method 6010

Range	1,000 Foot	Close Combat	Close Combat	Field Fire Rifle	Field Fire Rifle	Machine Gun-North	Machine Gun-North
Sample Point ID	1000FT-23	CLOSE_COMB-19	CLOSE_COMB-21	FIELD_FIRING_RIFLE-4	FIELD_FIRING_RIFLE-15	MG_SOUTH-15	MG_SOUTH-18
Sample Number	S13830310C	S01930304C	S02130303C	S07930228C	S09030228C	S20330307C	S20630311C
Priority Pollutant Metal	**Concentration (mg/Kg)**						
Antimony	<11.6	<11.0	<11.1	<11.0	<10.6	<9.7	<11.1
Arsenic	<23.2	<22.0	<22.1	<22.0	<21.1	<19.3	<22.1
Barium	137.0	227.0	145.0	146.0	194.0	178.0	200.0
Cadmium	<1.16	<1.1	<1.11	<1.1	<1.06	<.97	<1.11
Chromium	28.2	28.1	33.3	23.4	33.0	23.9	26.0
Copper	69.5	90.8	82.6	81.3	115.0	41.5	88.2
Lead	19.7	13.0	12.4	12.5	17.7	15.8	15.0
Nickel	28.1	<22.0	<22.1	<22.0	<21.1	20.8	29.0
Zinc	62.9	78.8	58.1	74.9	73.7	89.0	81.1

Range	Machine Gun-South	Rifle Ranges 1&2	Sub Machine Gun	TF	Background Location	
Sample Point ID	MG_NORTH-18	RIFLE_RANGE-FP4 DUP	SUB_MACHINE-7	TF-5	None	None
Sample Number	S18030318C	S46830227C	S03530303C	S04030307C	S51030320C	S51730320C
Priority Pollutant Metal	**Concentration (mg/Kg)**					
Antimony	<11.7	<11.2	<11.7	<11.6	<11.7	<10.6
Arsenic	<23.4	22.9	<23.3	<23.2	<23.5	<21.2
Barium	192.0	202.0	133.0	163.0	92.4	156.0
Cadmium	<1.17	<1.1	<1.17	<1.16	<1.17	<1.06
Chromium	16.8	25.8	33.7	34.5	23.2	31.4
Copper	33.3	97.2	148.0	98.5	36.5	122.0
Lead	10.4	12.7	13.9	19.1	10.0	12.3
Nickel	<23.4	<22.5	<23.3	<23.2	<23.5	23.1
Zinc	65.2	129.0	75.9	68.3	55.4	77.2

Table A-20
Demolition Area 2 Samples - Priority Pollutant Metals by Method 6010

Sample Location	Center of Area			100 ft. North of Center			100 ft. South of Center		
Sample Depth	Surface	2.5 ft.	5 ft.	Surface	2.5 ft.	5 ft.	Surface	2.5 ft.	5 ft.
Sample Number	S70130227C	S70230227C	S70330227C	S70430227C	S70530227C	S70630227C	S70730227C	S70830227C	S70930227C
Priority Pollutant Metal	**Concentration (mg/Kg)**								
Antimony	<10.9	<10.9	NS	<10.7	<11.9	NS	<11.3	<11.5	<10.9
Arsenic	<21.8	<21.8	NS	<21.3	<23.7	NS	<22.6	<23.0	28.5
Barium	152.0	121.0	NS	208.0	215.0	NS	166.0	180.0	123.0
Cadmium	<1.1	<1.1	NS	<1.1	<1.2	NS	<1.1	<1.2	<1.1
Chromium	43.0	42.3	NS	25.3	36.7	NS	33.3	33.6	43.6
Copper	87.7	82.4	NS	70.7	127.0	NS	96.2	90.6	105.0
Lead	17.8	16.6	NS	17.6	23.9	NS	16.4	16.6	28.2
Nickel	<21.8	<21.8	NS	<21.3	<23.7	NS	<22.6	<23.0	<21.8
Zinc	101.0	52.6	NS	66.8	75.5	NS	61.1	76.2	73.7
Sample Location	100 ft. East of Center			100 ft. West of Center			Berm-SW	Berm-Center	Berm-NE
Sample Depth	Surface	2.5 ft.	4 ft.	Surface	2.5 ft.	5 ft.	2 ft.	2 ft.	2 ft.
Sample Number	S71030227C	S71130227C	S71230227C	S71330227C	S71430227C	S71530227C	S71630227C	S71730227C	S71830227C
Priority Pollutant Metal	**Concentration (mg/Kg)**								
Antimony	<11.7	<11.4	<11.6	<10.5	<11.1	NS	<10.4	<11.6	<11.8
Arsenic	<23.4	29.4	23.6	30.1	29.7	NS	<20.7	<23.3	29.3
Barium	228.0	262.0	454.0	181.0	130.0	NS	264.0	246.0	313.0
Cadmium	<1.2	<1.1	<1.2	<1.1	<1.1	NS	<1.0	<1.2	<1.2
Chromium	36.8	39.0	34.9	30.1	31.2	NS	30.3	34.2	37.1
Copper	117.0	120.0	160.0	77.4	63.8	NS	92.6	94.9	104.0
Lead	27.2	27.8	28.5	21.6	15.0	NS	16.8	22.3	24.9
Nickel	<23.4	<22.9	<23.1	<21.0	<22.1	NS	36.5	<23.3	<23.6
Zinc	84.7	66.2	81.2	69.4	50.0	NS	74.6	68.1	75.5

Table A-21
Demolition Area 3 Samples - Priority Pollutant Metals by Method 6010

Sample Location	Periphery-North		Periphery-South		Periphery-East		Periphery-West	
Sample Depth	Surface	2.5 ft.	Surface	2.5 ft.	Surface	2.5 ft.	Surface	2.5 ft.
Sample Number	S80330227C	S80430227C	S80530227C	S80630227C	S80730227C	S80830227C	S80930227C	S81030227C
Priority Pollutant Metal	**Concentration (mg/Kg)**							
Antimony	<11.0	<10.5	<10.5	<10.7	<11.1	<10.5	<11.2	<10.6
Arsenic	<22.1	<21.1	<20.9	<21.3	<22.1	<21.0	<22.5	<21.2
Barium	198.0	116.0	143.0	109.0	221.0	108.0	206.0	116.0
Cadmium	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Chromium	17.6	15.8	13.2	21.4	14.9	18.5	19.0	18.0
Copper	140.0	40.0	55.8	42.7	79.7	50.4	113.0	44.4
Lead	11.6	8.6	10.4	11.7	13.3	11.8	18.7	9.3
Nickel	<22.1	<21.1	<20.9	<21.3	<22.1	<21.0	<22.5	<21.2
Zinc	69.1	56.0	56.1	44.3	55.5	54.4	73.2	53.7

Table A-22
Demolition Area 3 Samples - Water
Priority Pollutant Metals by Method 6010

Sample Location	Water Standing in Crater
Sample Number	WDA230321P
Priority Pollutant Metal	**Concentration (ug/L)**
Antimony	**<50**
Arsenic	<100
Barium	<5.0
Cadmium	<5.0
Chromium	<5.0
Copper	<10.0
Lead	<50
Nickel	<20
Zinc	<10.0

Table A-23
25-Meter M60 Range/Pistol Range - Muzzle Blast Zone Samples

Sample Point ID	25M_M60-FP1	25M_M60-FP2	25M_M60-FP3	25M_M60-FP4	25M_M60-FP5	25M_M60-FP6
Sample Number	S60130304C	S60230304C	S60330304C	S60430304C	S60530304C	S60630304C
Constituent	**Concentration (mg/Kg)**					
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	< 2.7	< 2.5	< 2.6	< 3.2	< 2.8	< 3
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 2.7	< 2.5	< 2.6	< 3.2	< 2.8	< 3
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 2.7	< 2.5	< 2.6	< 3.2	< 2.8	< 3
1,3-Dinitrobenzene (1,3-DNB)	< 2.7	< 2.5	< 2.6	< 3.2	< 2.8	< 3
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 2.7	< 2.5	< 2.6	< 3.2	< 2.8	< 3
Nitrobenzene (NB)	< 2.7	< 2.5	< 2.6	< 3.2	< 2.8	< 3
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 2.7	< 2.5	< 2.6	< 3.2	< 2.8	< 3
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 2.7	< 2.5	< 2.6	< 3.2	< 2.8	< 3
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 2.7	< 2.5	< 2.6	< 3.2	< 2.8	< 3
2,4-Dinitrotoluene (2,4-DNT)	< 2.7	< 2.5	< 2.6	< 3.2	< 2.8	< 3
2,6-Dinitrotoluene (2,6-DNT)	< 2.7	< 2.5	< 2.6	< 3.2	< 2.8	< 3
2-Nitrotoluene (2-NT)	< 2.7	< 2.5	< 2.6	< 3.2	< 2.8	< 3
3-Nitrotoluene (3-NT)	< 2.7	< 2.5	< 2.6	< 3.2	< 2.8	< 3
4-Nitrotoluene (4-NT)	< 2.7	< 2.5	< 2.6	< 3.2	< 2.8	< 3
Picric Acid	< 10	< 10	< 10	< 10	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 14	< 13	< 13	< 16	< 14	< 15

Table A-24
TF Range - Muzzle Blast Zone Samples

Sample Point ID	TF-FP1	TF-FP2
Sample Number	S60730307C	S60830307C
Constituent	Concentration (mg/Kg)	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	< 2.6	< 3
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 2.6	< 3
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 2.6	< 3
1,3-Dinitrobenzene (1,3-DNB)	< 2.6	< 3
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 2.6	< 3
Nitrobenzene (NB)	< 2.6	< 3
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 2.6	< 3
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 2.6	< 3
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 2.6	< 3
2,4-Dinitrotoluene (2,4-DNT)	< 2.6	< 3
2,6-Dinitrotoluene (2,6-DNT)	< 2.6	< 3
2-Nitrotoluene (2-NT)	< 2.6	< 3
3-Nitrotoluene (3-NT)	< 2.6	< 3
4-Nitrotoluene (4-NT)	< 2.6	< 3
Picric Acid	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 13	< 15

Table A-25
Rifle Ranges 1 and 2 - Muzzle Blast Zone Samples

Sample Point ID	RIFLE_RANGE-FP1	RIFLE_RANGE-FP2	RIFLE_RANGE-FP3	RIFLE_RANGE-FP4	RIFLE_RANGE-FP5	RIFLE_RANGE-FP6	RIFLE_RANGE-FP7
Sample Number	S60930228C	S61030228C	S61130227C	S61230227C	S61330227C	S61430227C	S61530227C
Constituent	**Concentration (mg/Kg)**						
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	< 2.7	< 3.1	< 2.9	< 3	< 2.6	< 2.6	< 2.6
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 2.7	< 3.1	< 2.9	< 3	< 2.6	< 2.6	< 2.6
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 2.7	< 3.1	< 2.9	< 3	< 2.6	< 2.6	< 2.6
1,3-Dinitrobenzene (1,3-DNB)	< 2.7	< 3.1	< 2.9	< 3	< 2.6	< 2.6	< 2.6
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 2.7	< 3.1	< 2.9	< 3	< 2.6	< 2.6	< 2.6
Nitrobenzene (NB)	< 2.7	< 3.1	< 2.9	< 3	< 2.6	< 2.6	< 2.6
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 2.7	< 3.1	< 2.9	< 3	< 2.6	< 2.6	< 2.6
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 2.7	< 3.1	< 2.9	< 3	< 2.6	< 2.6	< 2.6
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 2.7	< 3.1	< 2.9	< 3	< 2.6	< 2.6	< 2.6
2,4-Dinitrotoluene (2,4-DNT)	< 2.7	< 3.1	< 2.9	< 3	< 2.6	< 2.6	< 2.6
2,6-Dinitrotoluene (2,6-DNT)	< 2.7	< 3.1	< 2.9	< 3	< 2.6	< 2.6	< 2.6
2-Nitrotoluene (2-NT)	< 2.7	< 3.1	< 2.9	< 3	< 2.6	< 2.6	< 2.6
3-Nitrotoluene (3-NT)	< 2.7	< 3.1	< 2.9	< 3	< 2.6	< 2.6	< 2.6
4-Nitrotoluene (4-NT)	< 2.7	< 3.1	< 2.9	< 3	< 2.6	< 2.6	< 2.6
Picric Acid	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 14	< 16	< 15	< 15	< 13	< 13	< 13

Table A-26
Field Fire Rifle Range 1 and 2 - Muzzle Blast Zone Samples

Sample Point ID	FIELD_FIRING_RIFLE-FP1	FIELD_FIRING_RIFLE-FP2
Sample Number	S61630228C	S61730228C
Constituent	Concentration (mg/Kg)	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	< 2.9	< 3
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 2.9	< 3
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 2.9	< 3
1,3-Dinitrobenzene (1,3-DNB)	< 2.9	< 3
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 2.9	< 3
Nitrobenzene (NB)	< 2.9	< 3
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 2.9	< 3
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 2.9	< 3
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 2.9	< 3
2,4-Dinitrotoluene (2,4-DNT)	< 2.9	< 3
2,6-Dinitrotoluene (2,6-DNT)	< 2.9	< 3
2-Nitrotoluene (2-NT)	< 2.9	< 3
3-Nitrotoluene (3-NT)	< 2.9	< 3
4-Nitrotoluene (4-NT)	< 2.9	< 3
Picric Acid	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 15	< 15

Table A-27
Infiltration Course North - Muzzle Blast Zone Samples

Sample Point ID	INFIL_NORTH-FP1	INFIL_NORTH-FP2
Sample Number	S61830301C	S61930301C
Constituent	**Concentration (mg/Kg)**	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	< 3	< 2.4
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 3	< 2.4
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 3	< 2.4
1,3-Dinitrobenzene (1,3-DNB)	< 3	< 2.4
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 3	< 2.4
Nitrobenzene (NB)	< 3	< 2.4
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 3	< 2.4
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 3	< 2.4
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 3	< 2.4
2,4-Dinitrotoluene (2,4-DNT)	< 3	< 2.4
2,6-Dinitrotoluene (2,6-DNT)	< 3	< 2.4
2-Nitrotoluene (2-NT)	< 3	< 2.4
3-Nitrotoluene (3-NT)	< 3	< 2.4
4-Nitrotoluene (4-NT)	< 3	< 2.4
Picric Acid	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 15	< 12

Table A-28
Field Firing Range 1 and 2 and Pistol Range - Muzzle Blast Zone Samples

Sample Point ID	FFR-1	FFR-2	FFR-3	FFR-4	FFR-5	FFR-6
Sample Number	S62030317C	S62130317C	S62230317C	S62330317C	S62430317C	S62530317C
Constituent	Concentration (mg/Kg)					
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	< 2.7	< 2.5	< 2.7	< 2.7	< 2.6	< 2.7
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 2.7	< 2.5	< 2.7	< 2.7	< 2.6	< 2.7
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 2.7	< 2.5	< 2.7	< 2.7	< 2.6	< 2.7
1,3-Dinitrobenzene (1,3-DNB)	< 2.7	< 2.5	< 2.7	< 2.7	< 2.6	< 2.7
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 2.7	< 2.5	< 2.7	< 2.7	< 2.6	< 2.7
Nitrobenzene (NB)	< 2.7	< 2.5	< 2.7	< 2.7	< 2.6	< 2.7
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 2.7	< 2.5	< 2.7	< 2.7	< 2.6	< 2.7
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 2.7	< 2.5	< 2.7	< 2.7	< 2.6	< 2.7
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 2.7	< 2.5	< 2.7	< 2.7	< 2.6	< 2.7
2,4-Dinitrotoluene (2,4-DNT)	< 2.7	< 2.5	< 2.7	< 2.7	< 2.6	< 2.7
2,6-Dinitrotoluene (2,6-DNT)	< 2.7	< 2.5	< 2.7	< 2.7	< 2.6	< 2.7
2-Nitrotoluene (2-NT)	< 2.7	< 2.5	< 2.7	< 2.7	< 2.6	< 2.7
3-Nitrotoluene (3-NT)	< 2.7	< 2.5	< 2.7	< 2.7	< 2.6	< 2.7
4-Nitrotoluene (4-NT)	< 2.7	< 2.5	< 2.7	< 2.7	< 2.6	< 2.7
Picric Acid	< 10	< 10	< 10	< 10	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 14	< 13	< 14	< 14	< 13	< 14

Table A-29
Combat Pistol Range - Muzzle Blast Zone Samples

Sample Point ID	COMB_PISTOL-FP1	COMB_PISTOL-FP2	COMB_PISTOL-FP3	COMB_PISTOL-FP4	COMB_PISTOL-FP5	COMB_PISTOL-FP6
Sample Number	S62630313C	S62730313C	S62830313C	S62930313C	S63030313C	S63130313C
Constituent	**Concentration (mg/Kg)**					
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	< 2.4	< 2.8	< 2.6	< 2.6	< 2.5	< 2.8
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 2.4	< 2.8	< 2.6	< 2.6	< 2.5	< 2.8
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 2.4	< 2.8	< 2.6	< 2.6	< 2.5	< 2.8
1,3-Dinitrobenzene (1,3-DNB)	< 2.4	< 2.8	< 2.6	< 2.6	< 2.5	< 2.8
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 2.4	< 2.8	< 2.6	< 2.6	< 2.5	< 2.8
Nitrobenzene (NB)	< 2.4	< 2.8	< 2.6	< 2.6	< 2.5	< 2.8
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 2.4	< 2.8	< 2.6	< 2.6	< 2.5	< 2.8
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 2.4	< 2.8	< 2.6	< 2.6	< 2.5	< 2.8
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 2.4	< 2.8	< 2.6	< 2.6	< 2.5	< 2.8
2,4-Dinitrotoluene (2,4-DNT)	< 2.4	< 2.8	< 2.6	< 2.6	< 2.5	< 2.8
2,6-Dinitrotoluene (2,6-DNT)	< 2.4	< 2.8	< 2.6	< 2.6	< 2.5	< 2.8
2-Nitrotoluene (2-NT)	< 2.4	< 2.8	< 2.6	< 2.6	< 2.5	< 2.8
3-Nitrotoluene (3-NT)	< 2.4	< 2.8	< 2.6	< 2.6	< 2.5	< 2.8
4-Nitrotoluene (4-NT)	< 2.4	< 2.8	< 2.6	< 2.6	< 2.5	< 2.8
Picric Acid	< 10	< 10	< 10	< 10	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 12	< 14	< 13	< 13	< 13	< 14

Table A-30
M31 Sub-Caliber Ranges 1 and 2 - Muzzle Blast Zone Samples

Sample Point ID	SUB_CAL-FP1	SUB_CAL-FP2	SUB_CAL-FP3	SUB_CAL-FP4	SUB_CAL-FP5	SUB_CAL-FP6
Sample Number	S63330318C	S63430318C	S63530318C	S63630318C	S63730318C	S63830318C
Constituent	**Concentration (mg/Kg)**					
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	< 2.4	< 2.3	< 2.5	< 2.3	< 2.3	< 2.4
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 2.4	< 2.3	< 2.5	< 2.3	< 2.3	< 2.4
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 2.4	< 2.3	< 2.5	< 2.3	< 2.3	< 2.4
1,3-Dinitrobenzene (1,3-DNB)	< 2.4	< 2.3	< 2.5	< 2.3	< 2.3	< 2.4
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 2.4	< 2.3	< 2.5	< 2.3	< 2.3	< 2.4
Nitrobenzene (NB)	< 2.4	< 2.3	< 2.5	< 2.3	< 2.3	< 2.4
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 2.4	< 2.3	< 2.5	< 2.3	< 2.3	< 2.4
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 2.4	< 2.3	< 2.5	< 2.3	< 2.3	< 2.4
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 2.4	< 2.3	< 2.5	< 2.3	< 2.3	< 2.4
2,4-Dinitrotoluene (2,4-DNT)	< 2.4	< 2.3	< 2.5	< 2.3	< 2.3	< 2.4
2,6-Dinitrotoluene (2,6-DNT)	< 2.4	< 2.3	< 2.5	< 2.3	< 2.3	< 2.4
2-Nitrotoluene (2-NT)	< 2.4	< 2.3	< 2.5	< 2.3	< 2.3	< 2.4
3-Nitrotoluene (3-NT)	< 2.4	< 2.3	< 2.5	< 2.3	< 2.3	< 2.4
4-Nitrotoluene (4-NT)	< 2.4	< 2.3	< 2.5	< 2.3	< 2.3	< 2.4
Picric Acid	< 10	< 10	< 10	< 10	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 12	< 12	< 13	< 12	< 12	< 12

Table A-31
25-Meter and Machine Gun Range - Muzzle Blast Zone Samples

Sample Point ID	25M_MG-FP1	25M_MG-FP2	25M_MG-FP3	25M_MG-FP4	25M_MG-FP5	25M_MG-FP6	25M_MG-FP7	25M_MG-FP8	25M_MG-FP9	25M_MG-FP10
Sample Number	S63930306C	S64030306C	S64130306C	S64230306C	S64330306C	S64430306C	S64530306C	S64630306C	S64730306C	S64830306C
Constituent	**Concentration (mg/Kg)**									
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	< 2.5	< 2.7	< 3.3	< 3	< 2.9	< 2.4	< 2.9	< 2.9	< 2.9	< 2.8
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 2.5	< 2.7	< 3.3	< 3	< 2.9	< 2.4	< 2.9	< 2.9	< 2.9	< 2.8
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 2.5	< 2.7	< 3.3	< 3	< 2.9	< 2.4	< 2.9	< 2.9	< 2.9	< 2.8
1,3-Dinitrobenzene (1,3-DNB)	< 2.5	< 2.7	< 3.3	< 3	< 2.9	< 2.4	< 2.9	< 2.9	< 2.9	< 2.8
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 2.5	< 2.7	< 3.3	< 3	< 2.9	< 2.4	< 2.9	< 2.9	< 2.9	< 2.8
Nitrobenzene (NB)	< 2.5	< 2.7	< 3.3	< 3	< 2.9	< 2.4	< 2.9	< 2.9	< 2.9	< 2.8
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 2.5	< 2.7	< 3.3	< 3	< 2.9	< 2.4	< 2.9	< 2.9	< 2.9	< 2.8
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 2.5	< 2.7	< 3.3	< 3	< 2.9	< 2.4	< 2.9	< 2.9	< 2.9	< 2.8
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 2.5	< 2.7	< 3.3	< 3	< 2.9	< 2.4	< 2.9	< 2.9	< 2.9	< 2.8
2,4-Dinitrotoluene (2,4-DNT)	< 2.5	< 2.7	12	12	17	5.4	20	14	10	4.9
2,6-Dinitrotoluene (2,6-DNT)	< 2.5	< 2.7	< 3.3	< 3	< 2.9	< 2.4	< 2.9	< 2.9	< 2.9	< 2.8
2-Nitrotoluene (2-NT)	< 2.5	< 2.7	< 3.3	< 3	< 2.9	< 2.4	< 2.9	< 2.9	< 2.9	< 2.8
3-Nitrotoluene (3-NT)	< 2.5	< 2.7	< 3.3	< 3	< 2.9	< 2.4	< 2.9	< 2.9	< 2.9	< 2.8
4-Nitrotoluene (4-NT)	< 2.5	< 2.7	< 3.3	< 3	< 2.9	< 2.4	< 2.9	< 2.9	< 2.9	< 2.8
Picric Acid	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 13	< 14	< 17	< 15	< 15	< 12	< 15	< 15	< 15	< 14

Table A-32
Infiltration Course South - Muzzle Blast Zone Samples

Sample Point ID	INFIL_SOUTH-FP1	INFIL_SOUTH-FP2	INFIL_SOUTH-FP3	INFIL_SOUTH-FP4	INFIL_SOUTH-FP5	INFIL_SOUTH-FP6	INFIL_SOUTH-FP7
Sample Number	S64930306C	S65030306C	S65130306C	S65230306C	S65330306C	S65430306C	S65530306C
Constituent	**Concentration (mg/Kg)**						
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	< 2.9	< 2.7	< 2.8	< 3	< 2.9	< 3	< 3
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 2.9	< 2.7	< 2.8	< 3	< 2.9	< 3	< 3
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 2.9	< 2.7	< 2.8	< 3	< 2.9	< 3	< 3
1,3-Dinitrobenzene (1,3-DNB)	< 2.9	< 2.7	< 2.8	< 3	< 2.9	< 3	< 3
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 2.9	< 2.7	< 2.8	< 3	< 2.9	< 3	< 3
Nitrobenzene (NB)	< 2.9	< 2.7	< 2.8	< 3	< 2.9	< 3	< 3
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 2.9	< 2.7	< 2.8	< 3	< 2.9	< 3	< 3
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 2.9	< 2.7	< 2.8	< 3	< 2.9	< 3	< 3
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 2.9	< 2.7	< 2.8	< 3	< 2.9	< 3	< 3
2,4-Dinitrotoluene (2,4-DNT)	< 2.9	< 2.7	< 2.8	< 3	< 2.9	< 3	< 3
2,6-Dinitrotoluene (2,6-DNT)	< 2.9	< 2.7	< 2.8	< 3	< 2.9	< 3	< 3
2-Nitrotoluene (2-NT)	< 2.9	< 2.7	< 2.8	< 3	< 2.9	< 3	< 3
3-Nitrotoluene (3-NT)	< 2.9	< 2.7	< 2.8	< 3	< 2.9	< 3	< 3
4-Nitrotoluene (4-NT)	< 2.9	< 2.7	< 2.8	< 3	< 2.9	< 3	< 3
Picric Acid	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 15	< 14	< 14	< 15	< 15	< 15	< 15

Table A-32
Infiltration Course South - Muzzle Blast Zone Samples

Sample Point ID	INFIL_SOUTH-FP8	INFIL_SOUTH-FP9	INFIL_SOUTH-FP10	INFIL_SOUTH-FP11	INFIL_SOUTH-FP12	INFIL_SOUTH-FP13	INFIL_SOUTH-FP14
Sample Number	S65630306C	S65730306C	S65830306C	S65930306C	S66030306C	S66130306C	S66230306C
Constituent	Concentration (mg/Kg)						
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	< 3.0	< 3.2	< 2.8	< 2.5	< 2.3	< 2.6	< 2.7
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 3.0	< 3.2	< 2.8	< 2.5	< 2.3	< 2.6	< 2.7
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 3.0	< 3.2	< 2.8	< 2.5	< 2.3	< 2.6	< 2.7
1,3-Dinitrobenzene (1,3-DNB)	< 3.0	< 3.2	< 2.8	< 2.5	< 2.3	< 2.6	< 2.7
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 3.0	< 3.2	< 2.8	< 2.5	< 2.3	< 2.6	< 2.7
Nitrobenzene (NB)	< 3.0	< 3.2	< 2.8	< 2.5	< 2.3	< 2.6	< 2.7
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 3.0	< 3.2	< 2.8	< 2.5	< 2.3	< 2.6	< 2.7
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 3.0	< 3.2	< 2.8	< 2.5	< 2.3	< 2.6	< 2.7
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 3.0	< 3.2	< 2.8	< 2.5	< 2.3	< 2.6	< 2.7
2,4-Dinitrotoluene (2,4-DNT)	< 3.0	< 3.2	< 2.8	< 2.5	< 2.3	< 2.6	< 2.7
2,6-Dinitrotoluene (2,6-DNT)	< 3.0	< 3.2	< 2.8	< 2.5	< 2.3	< 2.6	< 2.7
2-Nitrotoluene (2-NT)	< 3.0	< 3.2	< 2.8	< 2.5	< 2.3	< 2.6	< 2.7
3-Nitrotoluene (3-NT)	< 3.0	< 3.2	< 2.8	< 2.5	< 2.3	< 2.6	< 2.7
4-Nitrotoluene (4-NT)	< 3.0	< 3.2	< 2.8	< 2.5	< 2.3	< 2.6	< 2.7
Picric Acid	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 15	< 16	< 14	< 13	< 12	< 14	< 14

Table A-33
25M Record Fire Field Range, Field Firing Range - Muzzle Blast Zone Samples

Sample Point ID	25M_RECORD-FP1	25M_RECORD-FP1
Sample Number	S66330314C	S66430314C
Constituent	**Concentration (mg/Kg)**	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	**< 2.9**	< 2.7
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 2.9	< 2.7
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 2.9	< 2.7
1,3-Dinitrobenzene (1,3-DNB)	< 2.9	< 2.7
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 2.9	< 2.7
Nitrobenzene (NB)	< 2.9	< 2.7
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 2.9	< 2.7
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 2.9	< 2.7
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 2.9	< 2.7
2,4-Dinitrotoluene (2,4-DNT)	< 2.9	< 2.7
2,6-Dinitrotoluene (2,6-DNT)	< 2.9	< 2.7
2-Nitrotoluene (2-NT)	< 2.9	< 2.7
3-Nitrotoluene (3-NT)	< 2.9	< 2.7
4-Nitrotoluene (4-NT)	< 2.9	< 2.7
Picric Acid	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 15	< 14

Table A-34
Undocumented Pistol Range - Muzzle Blast Zone Samples

Sample Point ID	UNDOC_PISTOL-FP1	UNDOC_PISTOL-FP2	UNDOC_PISTOL-FP3	UNDOC_PISTOL-FP4	UNDOC_PISTOL-FP5
Sample Number	S66530301C	S66630301C	S66730301C	S66830301C	S66930301C
Constituent	**Concentration (mg/Kg)**				
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	**< 3.1**	**< 3**	**< 2.7**	**< 3**	< 2.8
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 3.1	< 3	< 2.7	< 3	< 2.8
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 3.1	< 3	< 2.7	< 3	< 2.8
1,3-Dinitrobenzene (1,3-DNB)	< 3.1	< 3	< 2.7	< 3	< 2.8
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 3.1	< 3	< 2.7	< 3	< 2.8
Nitrobenzene (NB)	< 3.1	< 3	< 2.7	< 3	< 2.8
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 3.1	< 3	< 2.7	< 3	< 2.8
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 3.1	< 3	< 2.7	< 3	< 2.8
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 3.1	< 3	< 2.7	< 3	< 2.8
2,4-Dinitrotoluene (2,4-DNT)	< 3.1	< 3	< 2.7	< 3	< 2.8
2,6-Dinitrotoluene (2,6-DNT)	< 3.1	< 3	< 2.7	< 3	< 2.8
2-Nitrotoluene (2-NT)	< 3.1	< 3	< 2.7	< 3	< 2.8
3-Nitrotoluene (3-NT)	< 3.1	< 3	< 2.7	< 3	< 2.8
4-Nitrotoluene (4-NT)	< 3.1	< 3	< 2.7	< 3	< 2.8
Picric Acid	< 10	< 10	< 10	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 16	< 15	< 14	< 15	< 14

Table A-35
Demolition Area 2 Samples

Sample Location	Center of Area			100 ft. North of Center			100 ft. South of Center		
Sample Depth	Surface	2.5 ft.	5 ft.	Surface	2.5 ft.	5 ft.	Surface	2.5 ft.	5 ft.
Sample Number	S70130227C	S70230227C	S70330227C	S70430227C	S70530227C	S70630227C	S70730227C	S70830227C	S70930227C
Constituent									
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	< 2.8	< 2.6	NS	< 2.7	< 2.8	NS	< 2.5	< 2.7	< 3
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 2.8	< 2.6	NS	< 2.7	< 2.8	NS	< 2.5	< 2.7	< 3
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 2.8	< 2.6	NS	< 2.7	< 2.8	NS	< 2.5	< 2.7	< 3
1,3-Dinitrobenzene (1,3-DNB)	< 2.8	< 2.6	NS	< 2.7	< 2.8	NS	< 2.5	< 2.7	< 3
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 2.8	< 2.6	NS	< 2.7	< 2.8	NS	< 2.5	< 2.7	< 3
Nitrobenzene (NB)	< 2.8	< 2.6	NS	< 2.7	< 2.8	NS	< 2.5	< 2.7	< 3
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 2.8	< 2.6	NS	< 2.7	< 2.8	NS	< 2.5	< 2.7	< 3
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 2.8	< 2.6	NS	< 2.7	< 2.8	NS	< 2.5	< 2.7	< 3
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 2.8	< 2.6	NS	< 2.7	< 2.8	NS	< 2.5	< 2.7	< 3
2,4-Dinitrotoluene (2,4-DNT)	< 2.8	< 2.6	NS	< 2.7	< 2.8	NS	< 2.5	< 2.7	< 3
2,6-Dinitrotoluene (2,6-DNT)	< 2.8	< 2.6	NS	< 2.7	< 2.8	NS	< 2.5	< 2.7	< 3
2-Nitrotoluene (2-NT)	< 2.8	< 2.6	NS	< 2.7	< 2.8	NS	< 2.5	< 2.7	< 3
3-Nitrotoluene (3-NT)	< 2.8	< 2.6	NS	< 2.7	< 2.8	NS	< 2.5	< 2.7	< 3
4-Nitrotoluene (4-NT)	< 2.8	< 2.6	NS	< 2.7	< 2.8	NS	< 2.5	< 2.7	< 3
Picric Acid	< 10	< 10	NS	< 10	< 10	NS	< 10	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 14	< 13	NS	< 14	< 14	NS	< 13	< 14	< 15
Perchlorate	< .033	< .033	NS	< .033	< .033	NS	< .033	< .033	< .033

Table A-35
Demolition Area 2 Samples

Sample Location	100 ft. East of Center			100 ft. West of Center			Berm-SW	Berm-Center	Berm-NE
Sample Depth	Surface	2.5 ft.	4 ft.	Surface	2.5 ft.	5 ft.	2 ft.	2 ft.	2 ft.
Sample Number	S71030227C	S71130227C	S71230227C	S71330227C	S71430227C	S71530227C	S71630227C	S71730227C	S71830227C
Constituent	**Concentration (mg/Kg)**								
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	< 3.1	< 2.7	< 3.2	< 2.9	< 2.5	NS	< 2.8	< 2.7	< 2.5
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 3.1	< 2.7	< 3.2	< 2.9	< 2.5	NS	< 2.8	< 2.7	< 2.5
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 3.1	< 2.7	< 3.2	< 2.9	< 2.5	NS	< 2.8	< 2.7	< 2.5
1,3-Dinitrobenzene (1,3-DNB)	< 3.1	< 2.7	< 3.2	< 2.9	< 2.5	NS	< 2.8	< 2.7	< 2.5
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 3.1	< 2.7	< 3.2	< 2.9	< 2.5	NS	< 2.8	< 2.7	< 2.5
Nitrobenzene (NB)	< 3.1	< 2.7	< 3.2	< 2.9	< 2.5	NS	< 2.8	< 2.7	< 2.5
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 3.1	< 2.7	< 3.2	< 2.9	< 2.5	NS	< 2.8	< 2.7	< 2.5
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 3.1	< 2.7	< 3.2	< 2.9	< 2.5	NS	< 2.8	< 2.7	< 2.5
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 3.1	< 2.7	< 3.2	< 2.9	< 2.5	NS	< 2.8	< 2.7	< 2.5
2,4-Dinitrotoluene (2,4-DNT)	< 3.1	< 2.7	< 3.2	< 2.9	< 2.5	NS	< 2.8	< 2.7	< 2.5
2,6-Dinitrotoluene (2,6-DNT)	< 3.1	< 2.7	< 3.2	< 2.9	< 2.5	NS	< 2.8	< 2.7	< 2.5
2-Nitrotoluene (2-NT)	< 3.1	< 2.7	< 3.2	< 2.9	< 2.5	NS	< 2.8	< 2.7	< 2.5
3-Nitrotoluene (3-NT)	< 3.1	< 2.7	< 3.2	< 2.9	< 2.5	NS	< 2.8	< 2.7	< 2.5
4-Nitrotoluene (4-NT)	< 3.1	< 2.7	< 3.2	< 2.9	< 2.5	NS	< 2.8	< 2.7	< 2.5
Picric Acid	< 10	< 10	< 10	< 10	< 10	NS	< 10	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 16	< 14	< 16	< 15	< 13	NS	< 14	< 4	< 13
Perchlorate	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	NS	< 0.033	< 0.033	< 0.033

Table A-36
Demolition Area 3 Samples

Sample Location	Periphery-North		Periphery-South		Periphery-East		Periphery-West	
Sample Depth	Surface	2.5 ft.	Surface	2.5 ft.	Surface	2.5 ft.	Surface	2.5 ft.
Sample Number	S80330227C	S80430227C	S80530227C	S80630227C	S80730227C	S80830227C	S80930227C	S81030227C
Constituent	**Concentration (mg/Kg)**							
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	< 2.8	< 2.5	< 3	< 2.6	< 2.5	< 2.5	< 2.7	< 2.5
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	< 2.8	< 2.5	< 3	< 2.6	< 2.5	< 2.5	< 2.7	< 2.5
1,3,5-Trinitrobenzene (1,3,5-TNB)	< 2.8	< 2.5	< 3	< 2.6	< 2.5	< 2.5	< 2.7	< 2.5
1,3-Dinitrobenzene (1,3-DNB)	< 2.8	< 2.5	< 3	< 2.6	< 2.5	< 2.5	< 2.7	< 2.5
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	< 2.8	< 2.5	< 3	< 2.6	< 2.5	< 2.5	< 2.7	< 2.5
Nitrobenzene (NB)	< 2.8	< 2.5	< 3	< 2.6	< 2.5	< 2.5	< 2.7	< 2.5
2,4,6-Trinitrotoluene (2,4,6-TNT)	< 2.8	< 2.5	< 3	< 2.6	< 2.5	< 2.5	< 2.7	< 2.5
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	< 2.8	< 2.5	< 3	< 2.6	< 2.5	< 2.5	< 2.7	< 2.5
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	< 2.8	< 2.5	< 3	< 2.6	< 2.5	< 2.5	< 2.7	< 2.5
2,4-Dinitrotoluene (2,4-DNT)	< 2.8	< 2.5	< 3	< 2.6	< 2.5	< 2.5	< 2.7	< 2.5
2,6-Dinitrotoluene (2,6-DNT)	< 2.8	< 2.5	< 3	< 2.6	< 2.5	< 2.5	< 2.7	< 2.5
2-Nitrotoluene (2-NT)	< 2.8	< 2.5	< 3	< 2.6	< 2.5	< 2.5	< 2.7	< 2.5
3-Nitrotoluene (3-NT)	< 2.8	< 2.5	< 3	< 2.6	< 2.5	< 2.5	< 2.7	< 2.5
4-Nitrotoluene (4-NT)	< 2.8	< 2.5	< 3	< 2.6	< 2.5	< 2.5	< 2.7	< 2.5
Picric Acid	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Pentaerythritol Tetranitrate (PETN)	< 14	< 13	< 15	< 13	< 13	< 13	< 14	< 13
Perchlorate	< .33	< .033	< .033	< .33	< .33	< .33	< .33	< .33

Table A-37
Demolition Area 3 Samples - Water

Sample Location	Water Standing in Crater
Sample Number	WDA230321P
Constituent	**Concentration (ug/L)**
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	<3
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	<3
1,3,5-Trinitrobenzene (1,3,5-TNB)	<3
1,3-Dinitrobenzene (1,3-DNB)	<3
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	<3
Nitrobenzene (NB)	<3
2,4,6-Trinitrotoluene (2,4,6-TNT)	<3
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	<3
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	<3
2,4-Dinitrotoluene (2,4-DNT)	<3
2,6-Dinitrotoluene (2,6-DNT)	<3
2-Nitrotoluene (2-NT)	<3
3-Nitrotoluene (3-NT)	<3
4-Nitrotoluene (4-NT)	<3
Picric Acid	<3
Pentaerythritol Tetranitrate (PETN)	<3
Perchlorate	<3

APPENDIX B

Figures of Sampling Results

INDEX TO APPENDIX B

FIGURE

INDEX TO APPENDIX B (CONTINUED)

FIGURE

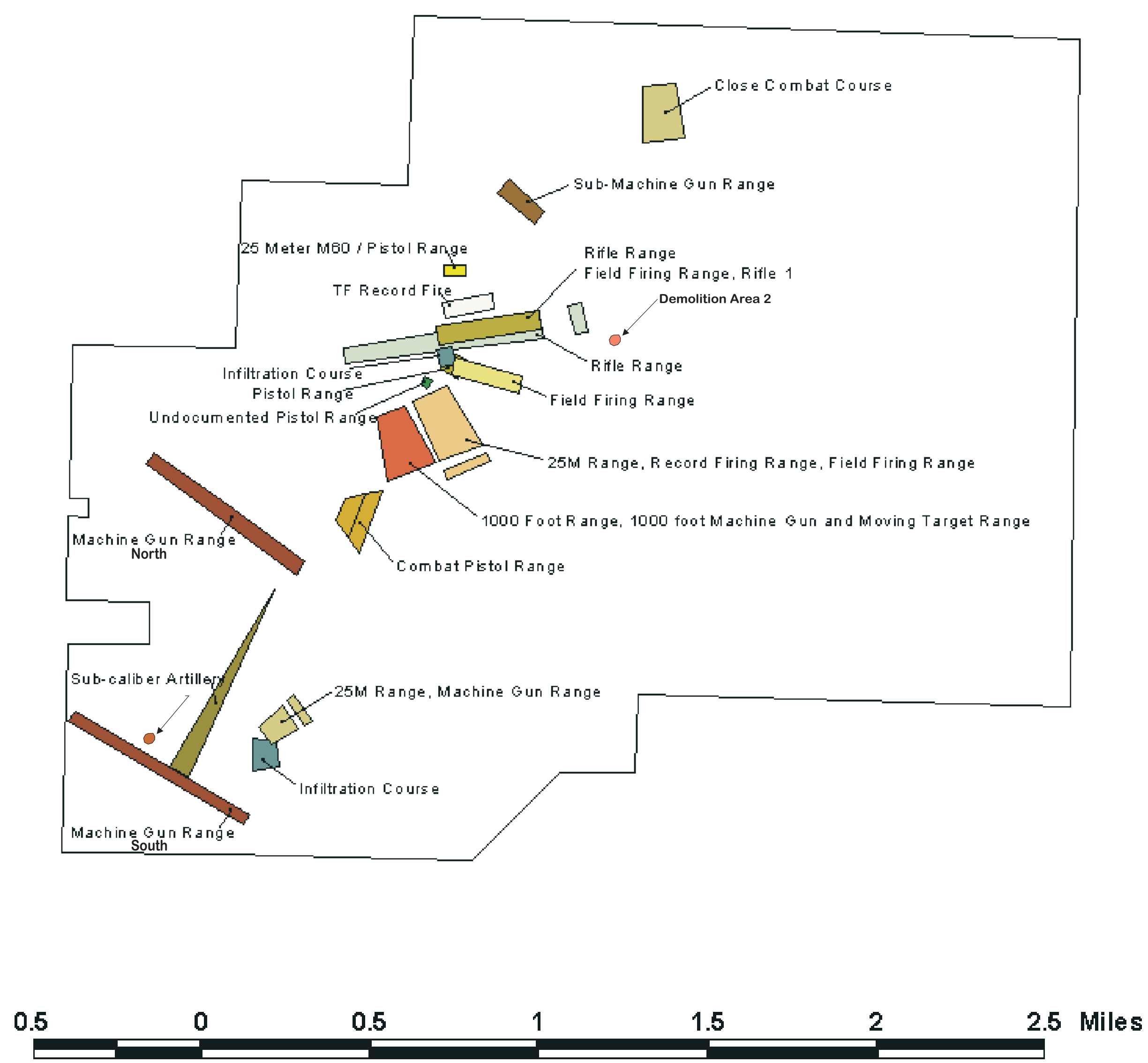


Figure B-1

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

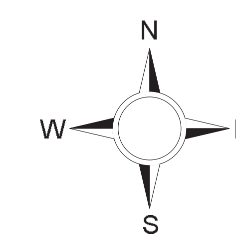
Contract Number: GS-10F-0135M

Site Map

Legend

Range Footprint

- 1000 Foot Range, 1000 foot Machine Gun and Moving Target Range
- 25 Meter M60 / Pistol Range
- 25M Range, Machine Gun Range
- 25M Range, Record Firing Range, Field Firing Range
- Close Combat Course
- Combat Pistol Range
- Demolition Area #2
- Demolition Area #3
- Field Firing Range
- Field Firing Range, Rifle 1
- Infiltration Course
- Machine Gun Range
- Pistol Range
- Rifle Range
- Sub-Machine Gun Range
- Sub-caliber Artillery
- TF Record Fire
- Undocumented Pistol Range
- Boundary



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S02130303C	15.5
S02130303N	12.9
S02130303S	12.1
S02130303E	18.8
S02130303W	19.1

S02230303C	21.7
S02230303N	14.5
S02230303S	18.6
S02230303E	22.2
S02230303W	15.1

S02330303C	15.4
S02330303N	18.4
S02330303S	16.1
S02330303E	19.8
S02330303W	16.7

S02430303C	14.0
S02430303N	12.6
S02430303S	17.2
S02430303E	15.3
S02430303W	21.4

S01830305C	14.9
S01830305N	9.4
S01830305S	16.5
S01830305E	15.9
S01830305W	16.3

S01730305C	10.7
S01730305N	23.9
S01730305S	11.7
S01730305E	14.2
S01730305W	14.1

S01430305C	7.1
S01430305N	88.3
S01430305S	8.3
S01430305E	12.6
S01430305W	10.6

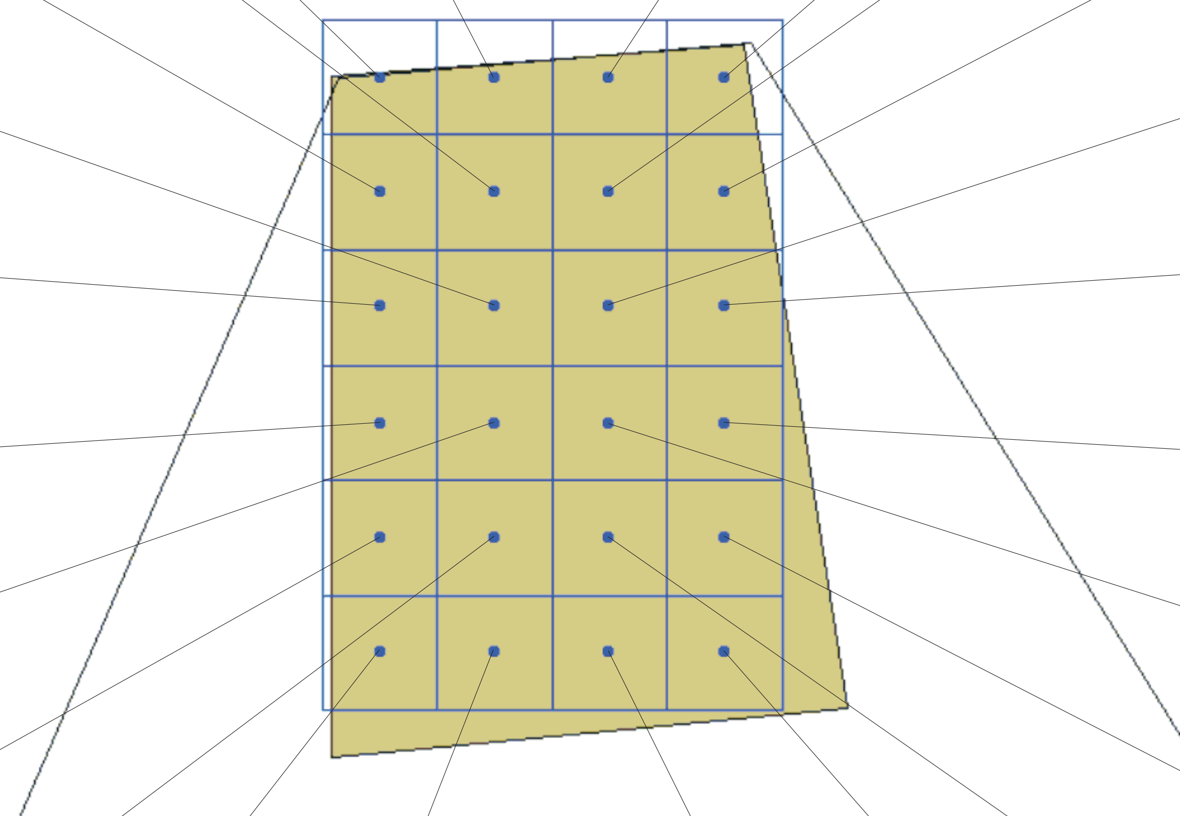
S01330305C	12.1
S01330305N	5.9
S01330305S	< 5.3
S01330305E	16.0
S01330305W	10.8

S00930305C	9.8
S00930305N	7.1
S00930305S	10.3
S00930305E	11.6
S00930305W	16.5

S01030305C	9.4
S01030305N	10.5
S01030305S	10.5
S01030305E	8.3
S01030305W	11.6

S00530305C	10.9
S00530305N	9.0
S00530305S	10.4
S00530305E	11.3
S00530305W	9.8

S00630305C	8.9
S00630305N	6.9
S00630305S	9.1
S00630305E	14.6
S00630305W	9.7



S01930304C	8.5
S01930304N	< 5.0
S01930304S	7.9
S01930304E	7.9
S01930304W	5.2

S02030304C	14.4
S02030304N	19.2
S02030304S	17.6
S02030304E	18.7
S02030304W	17.6

S01530304C	9.4
S01530304N	9.4
S01530304S	9.6
S01530304E	7.8
S01530304W	< 5.4

S01630304C	12.0
S01630304N	16.0
S01630304S	14.5
S01630304E	16.7
S01630304W	13.7

S01230304C	21.7
S01230304N	10.2
S01230304S	16.3
S01230304E	15.7
S01230304W	16.4

S01130304C	9.2
S01130304N	9.9
S01130304S	12.8
S01130304E	11.6
S01130304W	8.7

S00830304C	13.4
S00830304N	11.7
S00830304S	11.1
S00830304E	19.5
S00830304W	12.3

S00730304C	19.7
S00730304N	16.8
S00730304S	20.4
S00730304E	12.7
S00730304W	9.0

S00130305C	< 5.2
S00130305N	6.2
S00130305S	7.2
S00130305E	10.7
S00130305W	9.0

S00230305C	7.5
S00230305N	8.7
S00230305S	7.8
S00230305E	9.2
S00230305W	19.0

S00330304C	16.9
S00330304N	19.8
S00330304S	15.0
S00330304E	17.2
S00330304W	23.7

S00430304C	15.7
S00430304N	19.4
S00430304S	16.3
S00430304E	17.7
S00430304W	18.0

Figure B-2

Camp Bonneville

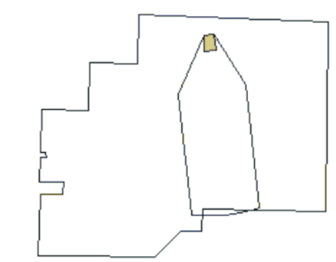
Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Close Combat Range Lead Results by Method 7420 (mg/Kg)

Key Map



Legend

- Sampling Grid Center Points
- Sampling Grid
- Range Fan

Range Footprint

- Close Combat Range

N

W E

S

200 0 200 400 Feet

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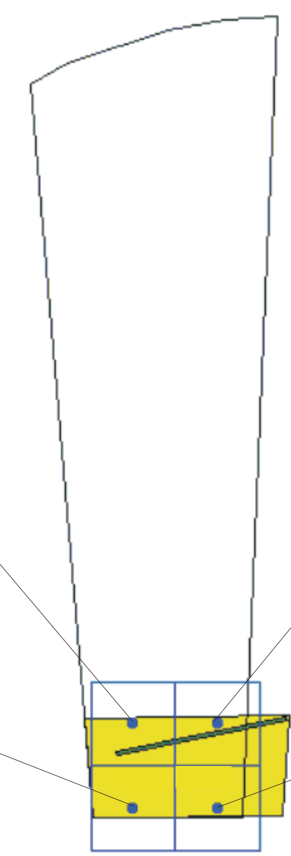

S02730304C	37.2
S02730304N	136
S02730304S	34.6
S02730304E	219
S02730304W	35.3

S02830304C	68.3
S02830304N	13.8
S02830304S	44.9
S02830304E	8.7
S02830304W	33.7

S02530304C	29.9
S02530304N	108
S02530304S	21.9
S02530304E	64.6
S02530304W	21.1

S02630304C	21.8
S02630304N	21.1
S02630304S	22.2
S02630304E	11.8
S02630304W	24.8

Figure B-3

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

25 Meter M60 Range/Pistol Range
Lead Results by Method 7420
(mg/Kg)

Key Map

Legend

Sampling Grid
Sampling Grid Center Points
Berm
Range Fan
Range Footprint
25 Meter M60 / Pistol Range

N
W E
S

100 0 100 200 300 Feet

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Figure B-4

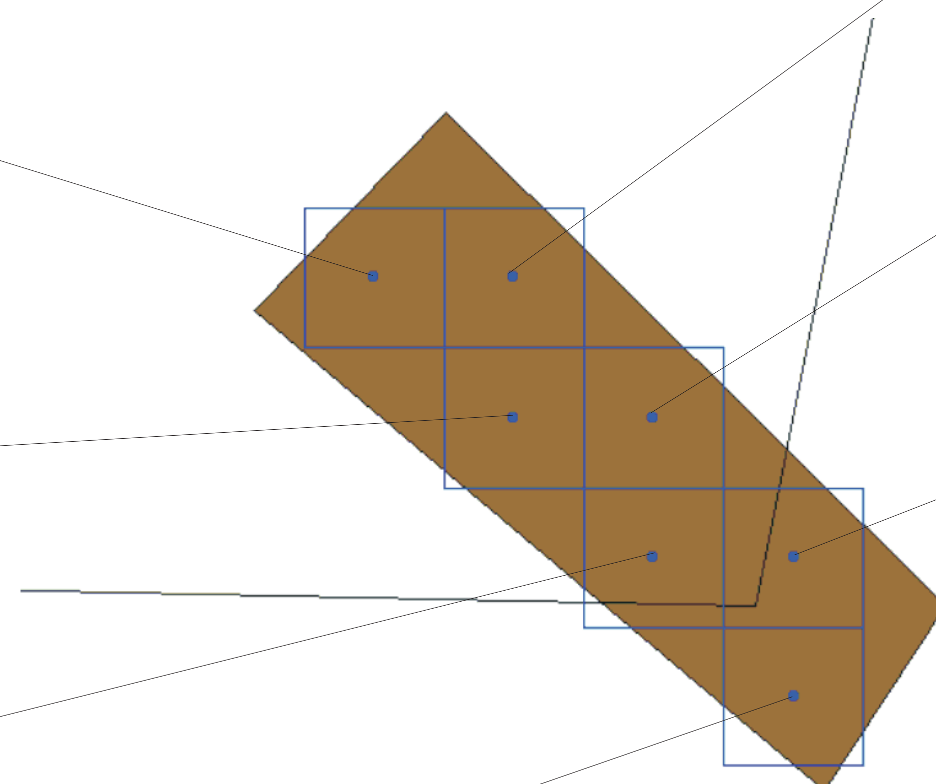
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Sub Machine Gun Range Lead Results by Method 7420 (mg/Kg)



S03430303C	13.1
S03430303N	10.4
S03430303S	11.2
S03430303E	10.3
S03430303W	10.0

S03230303C	9.2
S03230303N	10.9
S03230303S	11.6
S03230303E	9.0
S03230303W	6.8

S03030303C	7.0
S03030303N	8.9
S03030303S	18.4
S03030303E	6.9
S03030303W	10.0

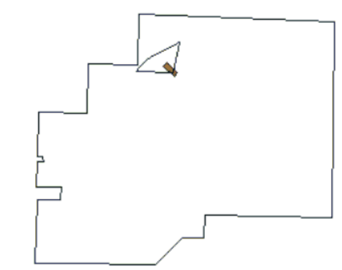
S02930303C	9.2
S02930303N	12.5
S02930303S	12.2
S02930303E	9.1
S02930303W	6.8

S03530303C	6.3
S03530303N	8.8
S03530303S	8.7
S03530303E	9.3
S03530303W	9.3

S03330303C	15.4
S03330303N	7.0
S03330303S	12.5
S03330303E	9.4
S03330303W	11.4

S03130303C	10.9
S03130303N	< 4.4
S03130303S	10.3
S03130303E	10.9
S03130303W	10.0

Key Map

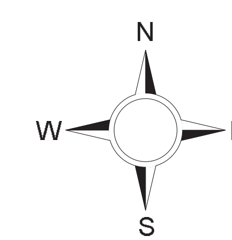


Legend

- Sampling Grid
- Sampling Grid Center Points
- Range Fan

Range Footprint

- Sub-Machine Gun Range



100 0 100 200 300 400 Feet

August 15, 2003

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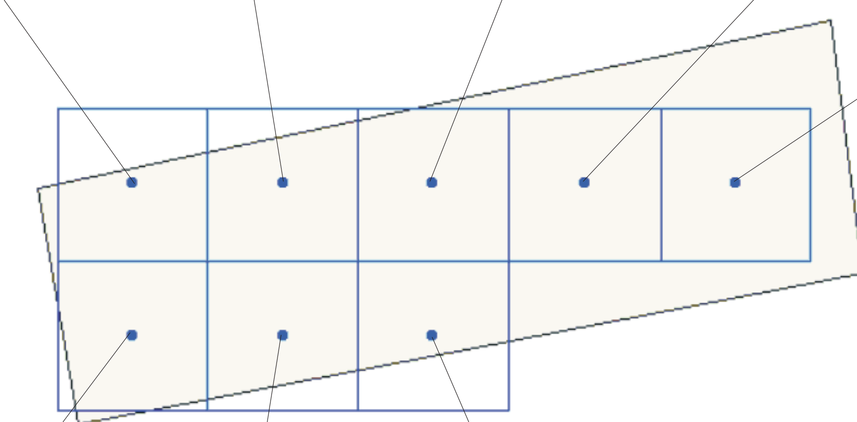
S03930307C	12.3
S03930307N	11.9
S03930307S	18.2
S03930307E	14.2
S03930307W	12.9

S04030307C	16.0
S04030307N	13.8
S04030310S	16.4
S04030307E	12.4
S04030307W	18.3

S04130307C	12.9
S04130307N	23.4
S04130307S	23.4
S04130307E	10.6
S04130307W	19.6

S04230307C	15.2
S04230307N	12.2
S04230307S	13.7
S04230307E	13.7
S04230307W	11.7

S04330307C	10.9
S04330307N	8.7
S04330307S	9.3
S04330307E	12.9
S04330307W	12.4



S03630307C	18.2
S03630307N	15.4
S03630307S	30.2
S03630307E	17.5
S03630307W	9.4

S03730307C	10.2
S03730307N	12.5
S03730307S	< 5.5
S03730307E	10.2
S03730307W	9.5

S03830307C	11.5
S03830310N	20.1
S03830307S	11.7
S03830307E	12.0
S03830307W	10.9

Figure B-5

Camp Bonneville

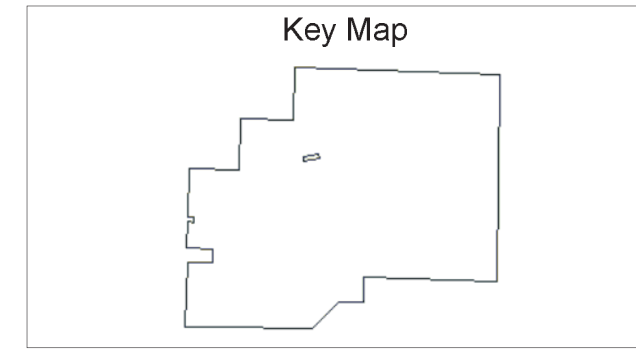
Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

TF Range
Lead Results by Method 7420
(mg/Kg)

Key Map



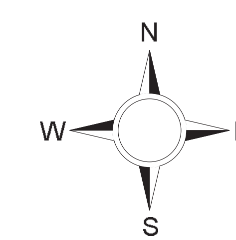
Legend

Sampling Grid

Sampling Grid Center Points

Range Footprint

TF Record Fire



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S05230225C	37.3
S05230225N	35.4
S05230225S	19.5
S05230225E	51.6
S05230225W	18.7

S05130225C	11.3
S05130225N	25.5
S05130225S	10.5
S05130225E	52.8
S05130225W	24.2

S05030225C	17.0
S05030225N	24.4
S05030225S	16.3
S05030225E	31.4
S05030225W	29.6

S04930225C	27.9
S04930225N	31.8
S04930225S	17.1
S04930225E	21.6
S04930225W	39.4

S04830225C	32.9
S04830225N	22.5
S04830225S	55.8
S04830225E	34.4
S04830225W	21.3

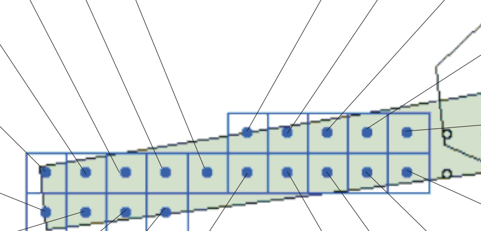
S04430225C	< 10.5
S04430225N	< 10.1
S04430225S	11.4
S04430225E	10.7
S04430225W	11.8

S04530225C	25.9
S04530225N	19.2
S04530225S	18.4
S04530225E	16.2
S04530225W	21.9

S04630225C	17.5
S04630225N	17.3
S04630225S	15.5
S04630225E	15.6
S04630225W	6.8

S04730225C	10.7
S04730225N	15.6
S04730225S	11.2
S04730225E	13.2
S04730225W	11.2

S05330225C	16.1
S05330225N	15.5
S05330225S	80.7
S05330225E	13.6
S05330225W	22.7



S05830225C	67.0
S05830225N	108
S05830225S	25.4
S05830225E	24.6
S05830225W	41.8

S05930225C	< 3.9
S05930225N	25.0
S05930225S	12.5
S05930225E	< 3.7
S05930225W	5.8

S06030226C	17.0
S06030226N	21.3
S06030226S	19.3
S06030226E	18.9
S06030226W	69.9

S06130226C	8.1
S06130226N	11.1
S06130226S	15.1
S06130226E	12.0
S06130226W	< 5.9

S06230226C	17.2
S06230226N	52.1
S06230226S	19.2
S06230226E	14.4
S06230226W	14.2

S05730226C	9.0
S05730226N	19.3
S05730226S	14.0
S05730226E	18.9
S05730226W	11.0

S05630226C	8.7
S05630226N	5.3
S05630226S	10.3
S05630226E	7.9
S05630226W	14.5

S05530225C	16.4
S05530225N	32.8
S05530225S	15.3
S05530225E	6.9
S05530225W	14.2

S05430225C	15.6
S05430225N	10.5
S05430225S	49.3
S05430225E	26.0
S05430225W	16.2

Figure B-6a

Camp Bonneville

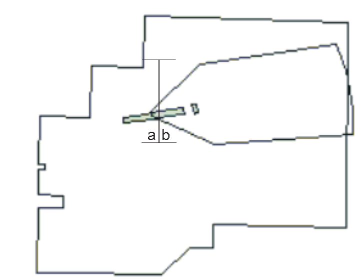
Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Rifle Ranges 1 and 2 Lead Results by Method 7420 (mg/Kg)

Key Map



Legend

Sampling Grid

Sampling Grid Center Points

Field Firing Range, Rifle 1 & Rifle Range 1

Infiltration Course 1 & Rifle Range 1

Rifle Range 1

Rifle Range 1 (drop zone)

Range Fan

Range Footprint

Rifle Range

N W E S

300 0 300 600 900 Feet

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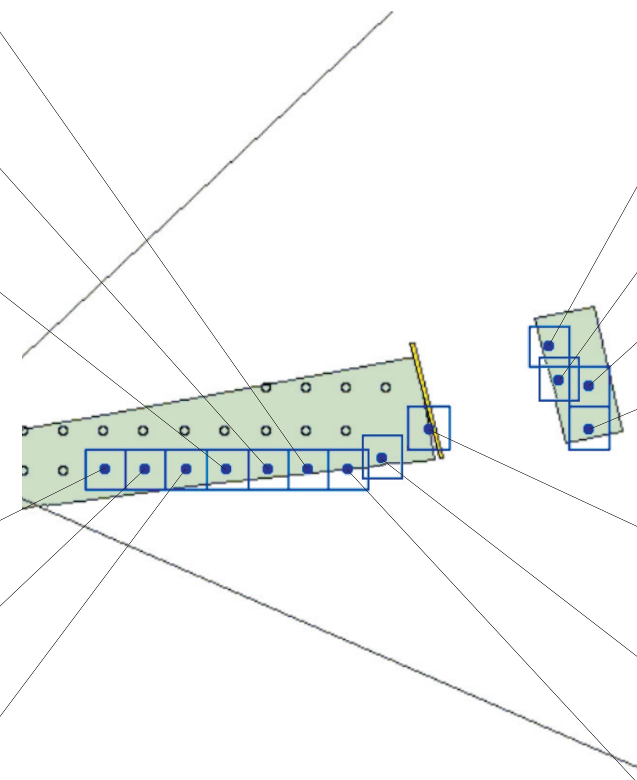
S06830226C	51.3
S06830226N	145
S06830226S	212
S06830226E	172
S06830226W	15.2

S06730226C	92.3
S06730226N	9.6
S06730226S	36
S06730226E	108
S06730226W	132

S06630226C	11.7
S06630226N	11.2
S06630226S	19.1
S06630226E	130
S06630226W	12.2



S06330226C	12.5
S06330226N	14.2
S06330226S	6.5
S06330226E	6.4
S06330226W	34.8

S06430226C	21.1
S06430226N	5.8
S06430226S	17.4
S06430226E	290
S06430226W	14.0

S06530226C	< 5.0
S06530226N	17.8
S06530226S	4.9
S06530226E	6.7
S06530226W	5.6

S07430226C	199
S07430226N	94.5
S07430226S	96.8
S07430226E	180
S07430226W	1770

S07530226C	82.4
S07530226N	59.1
S07530226S	417
S07530226E	670
S07530226W	220

S07330226C	273
S07330226N	1690
S07330226S	1750
S07330226E	1850
S07330226W	4330

S07230226C	65.0
S07230226N	137
S07230226S	23.0
S07230226E	23.0
S07230226W	74.8

S07130226C	9.3
S07130226N	87.6
S07130226S	4.7
S07130226E	95.8
S07130226W	5.6

S07030226C	7.4
S07030226N	11.3
S07030226S	29.2
S07030226E	21.6
S07030226W	8.3

S06930226C	22.4
S06930226N	3.6
S06930226S	21.2
S06930226E	9.5
S06930226W	< 4.5

Figure B-6b

Camp Bonneville

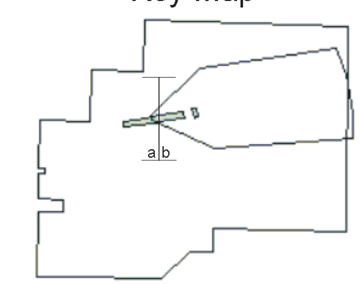
Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Rifle Ranges 1 and 2 Lead Results by Method 7420 (mg/Kg)

Key Map



Legend

- Sampling Grid
- Sampling Grid Center Points
  - Field Firing Range, Rifle 1 & Rifle Range 1
  - Infiltration Course 1 & Rifle Range 1
  - Rifle Range 1
  - Rifle Range 1 (drop zone)
- Berm
- Range Fan
- Range Footprint
  - Rifle Range

N

W E

S

300 0 300 600 900 Feet

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Figure B-7

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Field Fire Rifle Range 1 & 2
Lead Results by Method 7420
(mg/Kg)

S08630228C	13.4
S08630228N	10.1
S08630228S	61.0
S08630228E	6.9
S08630228W	7.5

S07730301C	23.6
S07730301N	14.2
S07730301S	17.5
S07730301E	23.6
S07730301W	7.4

S07830228C	48.8
S07830228N	16.8
S07830228S	14.6
S07830228E	13.5
S07830228W	11.2

S07930228C	11.0
S07930228N	9.4
S07930228S	15.4
S07930228E	16.2
S07930228W	< 5.2

S08030228C	97.0
S08030228N	7.4
S08030228S	23.7
S08030228E	69.9
S08030228W	11.2

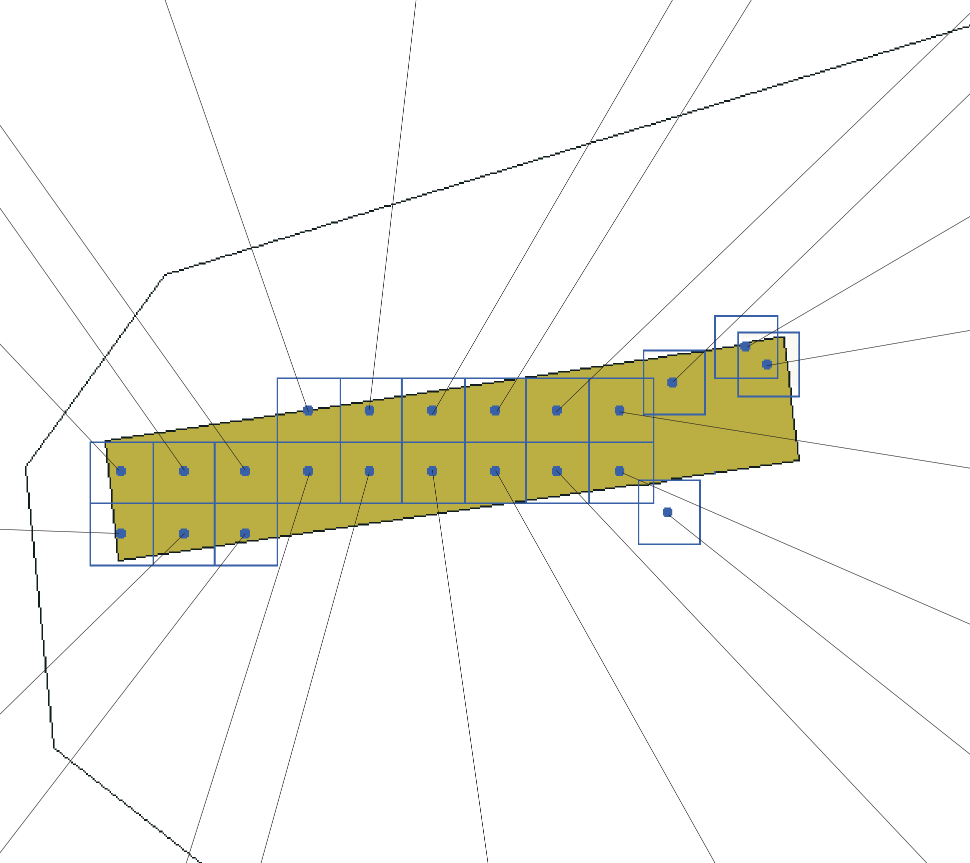
S09430228C	114
S09430228N	29.3
S09430228S	15.0
S09430228E	149
S09430228W	14.9

S08530228C	< 4.6
S08530228N	10.7
S08530228S	6.0
S08530228E	7.7
S08530228W	8.5

S09630301C	52.3
S09630301N	23.8
S09630301S	13.9
S09630301E	11.2
S09630301W	24.7

S07630228C	6.4
S07630228N	< 5.0
S07630228S	7.4
S07630228E	11.2
S07630228W	8.6

S08130301C	62.4
S08130301N	15.2
S08130301S	7.4
S08130301E	6.1
S08130301W	29.4



S09730301C	5.8
S09730301N	47.3
S09730301S	8.2
S09730301E	9.0
S09730301W	52.6

S08230228C	18.7
S08230228N	15.2
S08230228S	20.8
S08230228E	19.6
S08230228W	12.3

S09530228C	25.9
S09530228N	17.7
S09530228S	9.4
S09530228E	8.1
S09530228W	29.8

S09230228C	32.3
S09230228N	4.4
S09230228S	37.0
S09230228E	53.3
S09230228W	69.3

S08330228C	10.7
S08330228N	11.1
S08330228S	11.5
S08330228E	8.9
S08330228W	6.1

S09330301C	35.6
S09330301N	23.6
S09330301S	47.4
S09330301E	22.5
S09330301W	78.5

S08430228C	26.2
S08430228N	19.0
S08430228S	5.1
S08430228E	9.4
S08430228W	10.2

S08730228C	6.8
S08730228N	11.7
S08730228S	19.1
S08730228E	7.6
S08730228W	18.7

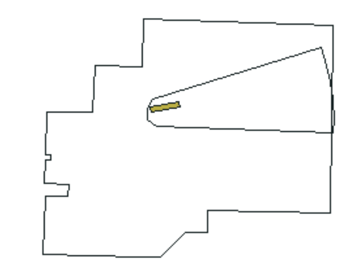
S08830228C	17.1
S08830228N	8.2
S08830228S	28.2
S08830228E	5.4
S08830228W	38.8

S08930228C	8.0
S08930228N	10.8
S08930228S	7.9
S08930228E	2300
S08930228W	9.3

S09030228C	8.4
S09030228N	9.1
S09030228S	20.6
S09030228E	44.4
S09030228W	7.4

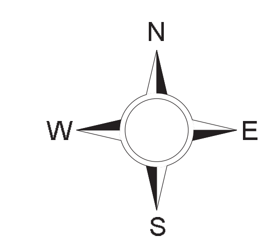
S09130228C	59.1
S09130228N	23.1
S09130228S	95.4
S09130228E	17.7
S09130228W	8.5

Key Map



Legend

Sampling Grid
Sampling Grid Center Points
• Field Firing Range, Rifle 1
• Field Firing Range, Rifle 1 & Rifle Range 1
Muzzle Blast Zone Sample Points
Range Fan
Range Footprint
Field Firing Range, Rifle 1



200 0 200 400 600 800 1000 Feet

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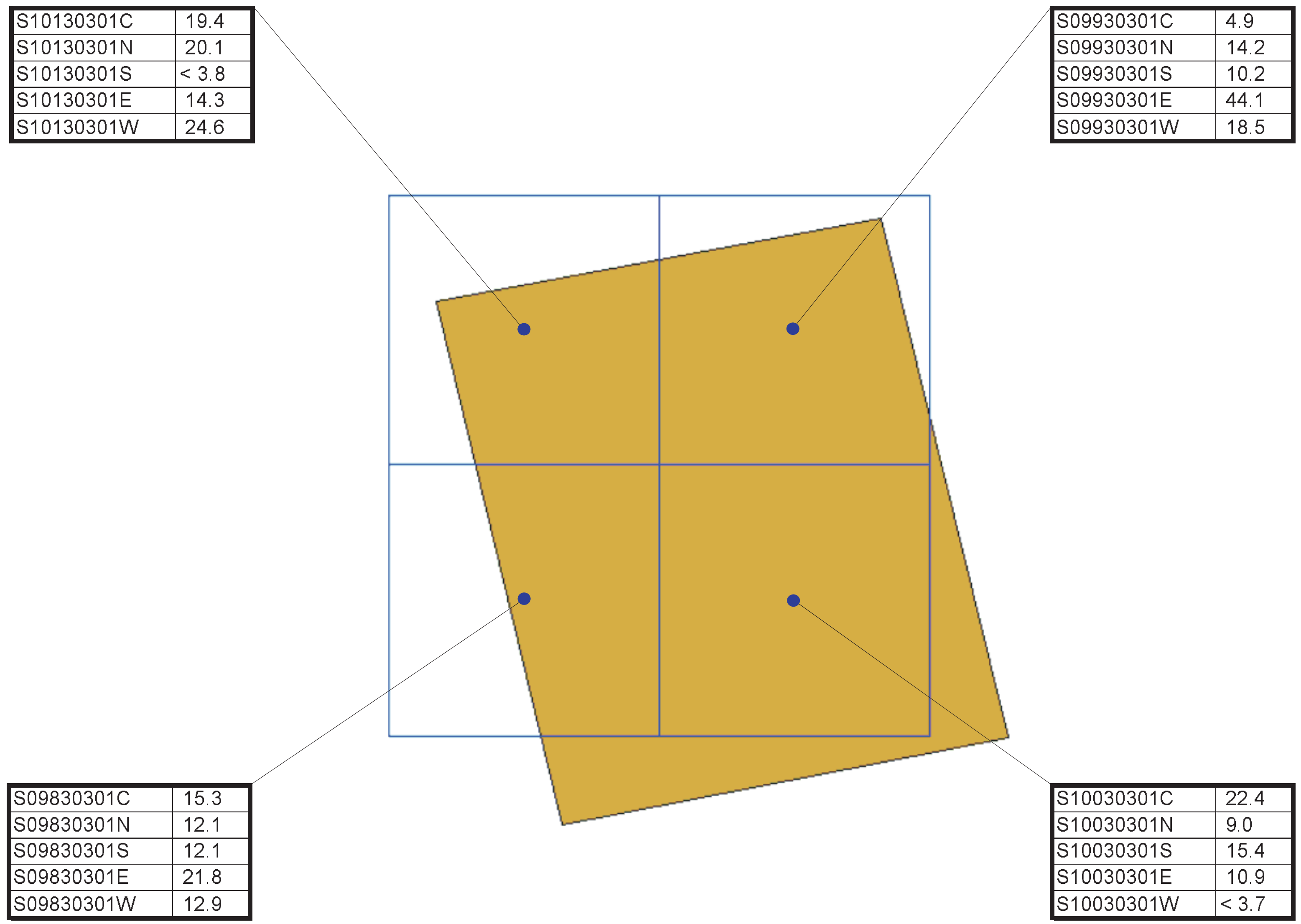


Figure B-8

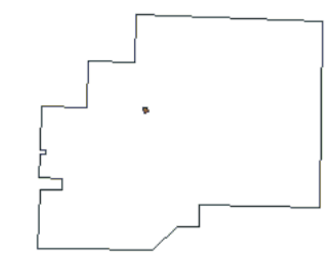
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

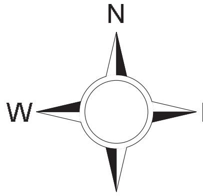
Infiltration Course North Lead Results by Method 7420 (mg/Kg)

Key Map



Legend

Sampling Grid
Sampling Grid Center Points
Infiltration Course 1
Range Footprint
Infiltration Course



90 0 90 180 Feet

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AEM
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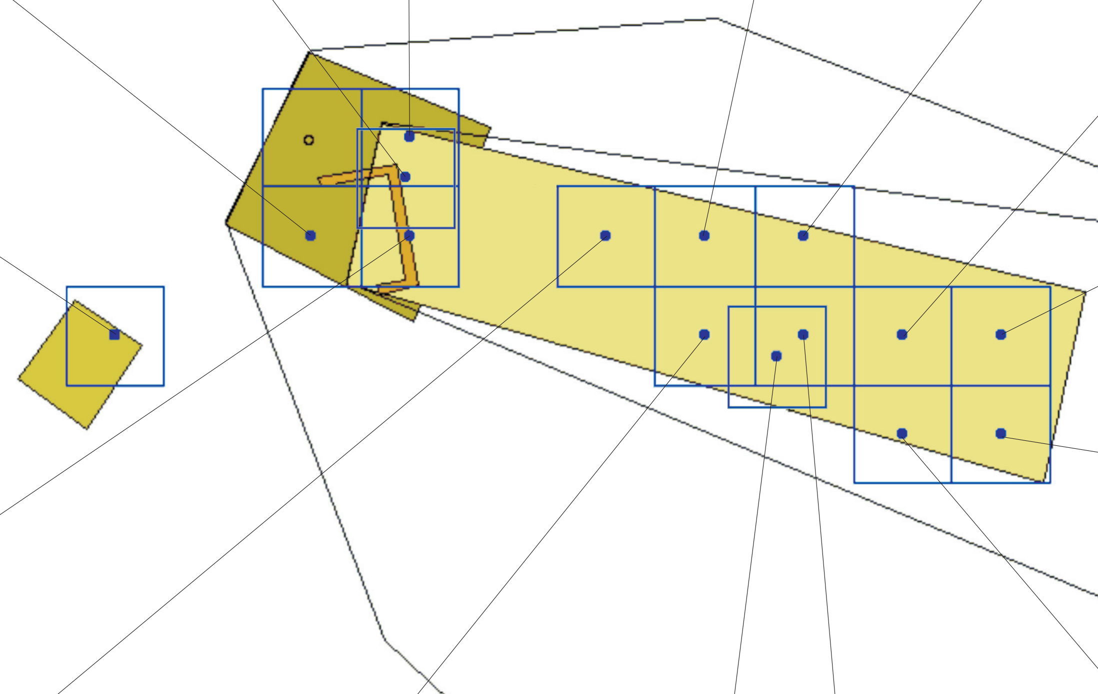
Figure B-9

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

Field Firing Ranges 1 & 2 and Undocumented Pistol Range Lead Results by Method 7420 (mg/Kg)



S10430317C	68.1
S10430317N	17.1
S10430317S	259
S10430317E	154
S10430317W	10.4

S11430312C	15.8
S11430312N	49.0
S11430312S	13.1
S11430312E	24.6
S11430312W	16.0

S11130312C	13.9
S11130312N	13.7
S11130312S	20.3
S11130312E	18.7
S11130312W	20.3

S11230312C	10.6
S11230312N	11.7
S11230312S	20.4
S11230312E	14.8
S11230312W	13.8

S11530312C	10.0
S11530312N	11.4
S11530312S	10.7
S11530312E	10.5
S11530312W	10.4

S30730301C	34.6
S30730301N	86.0
S30730301S	27.0
S30730301E	154
S30730301W	22.6

S10730312C	17.7
S10730312N	58.5
S10730312S	9.2
S10730312E	13.9
S10730312W	11.9

S10830312C	9.2
S10830312N	8.1
S10830312S	8.2
S10830312E	5.8
S10830312W	10.7

S11330312C	7150
S11330312N	125
S11330312S	267
S11330312E	728
S11330312W	187

S10330312C	8.6
S10330312N	6.9
S10330312S	9.9
S10330312E	8.1
S10330312W	13.8

S11030312C	13.1
S11030312N	11.8
S11030312S	17.2
S11030312E	136
S11030312W	19.6

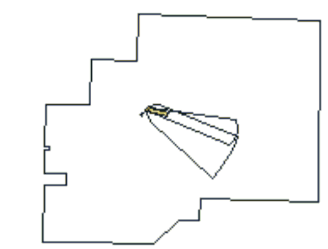
S10530312C	11.5
S10530312N	11.9
S10530312S	15.2
S10530312E	13.6
S10530312W	13.0

S10930317C	21.0
S10930317N	16.0
S10930317S	25.9
S10930317E	12.7
S10930317W	13.5

S10630312C	8.8
S10630312N	9.2
S10630312S	13.6
S10630312E	11.7
S10630312W	10.6

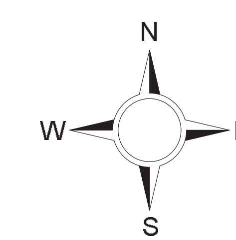
S10230312C	9.6
S10230312N	8.8
S10230312S	11.2
S10230312E	9.9
S10230312W	10.1

Key Map



Legend

Sampling Grid
Sampling Grid Center Points
Field Firing Range 1 & 2 & Pistol Range
Infiltration Course 1 & Pistol Range
Undocumented Pistol Range
Range Fan
Berms
Field Firing Ranges 1 and 2 and Pistol Range
Range Footprint
Field Firing Range
Pistol Range
Undocumented Pistol Range



200 0 200 400 600 Feet

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S14130310C	63.4
S14130310N	115
S14130310S	98.4
S14130310E	282
S14130310W	172

S13830310C	22.8
S13830310N	20.6
S13830310S	15.2
S13830310E	45.0
S13830310W	20.1

S14230310C	241
S14230310N	91.7
S14230310S	346
S14230310E	68.5
S14230310W	136

S14530310C	120
S14530310N	115
S14530310S	96.4
S14530310E	170
S14530310W	106

S14330310C	334
S14330310N	279
S14330310S	7610
S14330310E	2350
S14330310W	210

S14430310C	51.9
S14430310N	15.1
S14430310S	19.2
S14430310E	216
S14430310W	109

S13930310C	90.7
S13930310N	128
S13930310S	28.2
S13930310E	21.2
S13930310W	146

S13730310C	29.8
S13730310N	39.1
S13730310S	25.5
S13730310E	14.9
S13730310W	26.6

S13330310C	7.5
S13330310N	14.3
S13330310S	15.2
S13330310E	10.4
S13330310W	11.4

S13230310C	17.0
S13230310N	63.3
S13230310S	13.7
S13230310E	9.7
S13230310W	13.6

S12830310C	32.2
S12830310N	11.5
S12830310S	19.8
S12830310E	18.6
S12830310W	39.6

S12730310C	30.1
S12730310N	10.8
S12730310S	19.6
S12730310E	12.4
S12730310W	15.5

S12230314C	21.5
S12230314N	56.7
S12230314S	4.7
S12230314E	63.7
S12230314W	10.1

S12330314C	871
S12330314N	55.8
S12330314S	4560
S12330314E	198
S12330314W	566

S11830314C	10.0
S11830314N	9.3
S11830314S	22.6
S11830314E	7.8
S11830314W	9.1

S14030310C	10.0
S14030310N	48.3
S14030310S	13.4
S14030310E	13.9
S14030310W	28.1

S13430310C	9.9
S13430310N	22.8
S13430310S	15.0
S13430310E	11.7
S13430310W	6.2

S13530310C	16.6
S13530310N	11.3
S13530310S	11.9
S13530310E	12.4
S13530310W	22.9

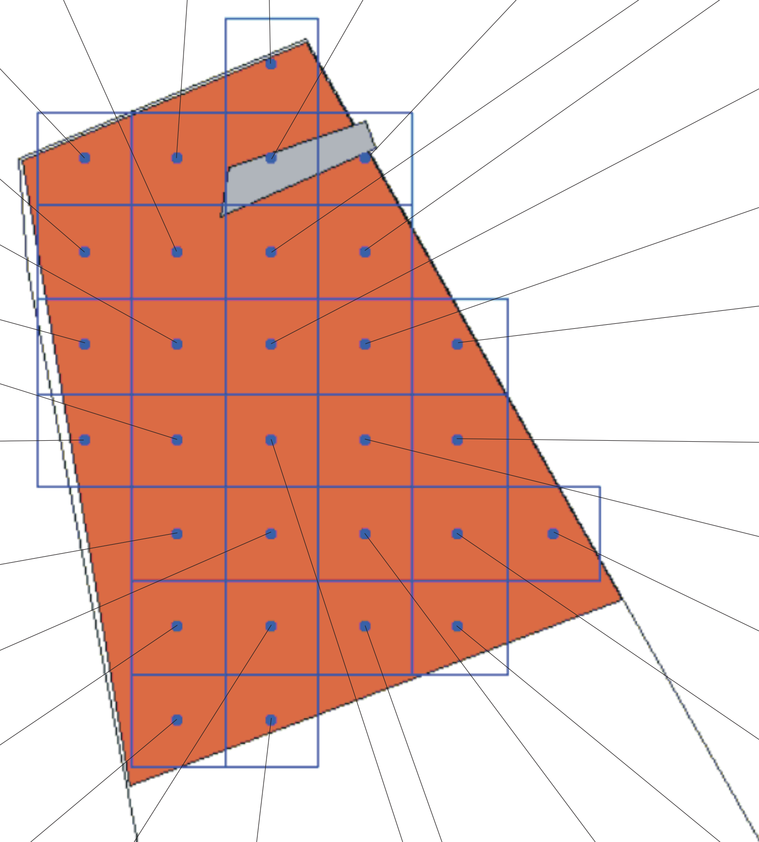
S13630310C	12.1
S13630310N	10.0
S13630310S	9.4
S13630310E	10.4
S13630310W	13.8

S13130310C	12.6
S13130310N	22.1
S13130310S	14.3
S13130310E	7.4
S13130310W	13.3

S13030310C	9.3
S13030310N	11.9
S13030310S	13.5
S13030310E	12.2
S13030310W	17.4

S12630314C	4.8
S12630314N	8.8
S12630314S	11.4
S12630314E	10.9
S12630314W	16.0

S12530314C	15.5
S12530314N	10.0
S12530314S	25.0
S12530314E	12.6
S12530314W	11.6



S11630314C	6.3
S11630314N	15.3
S11630314S	< 4.9
S11630314E	14.5
S11630314W	16.5

S11930314C	3450
S11930314N	10200
S11930314S	438
S11930314E	49.6
S11930314W	2350

S11730314C	16.4
S11730314N	16.6
S11730314S	15.5
S11730314E	16.7
S11730314W	13.8

S12930310C	15.3
S12930310N	14.8
S12930310S	15.2
S12930310E	13.1
S12930310W	7.5

S12030314C	58.0
S12030314N	14.8
S12030314S	12.5
S12030314E	12.7
S12030314W	17.2

S12430314C	16.0
S12430314N	25.3
S12430314S	24.8
S12430314E	14.2
S12430314W	17.4

S12130314C	10.1
S12130314N	11.7
S12130314S	12.3
S12130314E	11.5
S12130314W	9.9

Figure B-10

Camp Bonneville

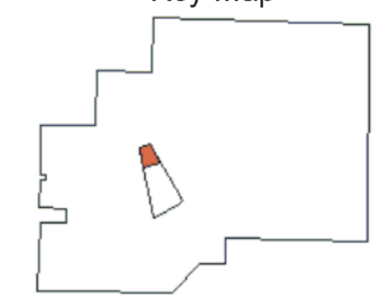
Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

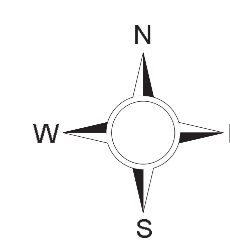
**1000 Ft. Range, 1000 Ft.
Machine Gun, and Moving Target Range
Lead Results by Method 7420
(mg/Kg)**

Key Map



Legend

Sampling Grid
Sampling Grid Center Points
1000 Foot Range Footprint
Berm
1000 Foot Range / 1000 Foot Machine Gun Range and Moving Target
Range Fan
Range Footprint
1000 Foot Range, 1000 foot Machine Gun and Moving Target Range



200 0 200 400 Feet

August 15, 2003

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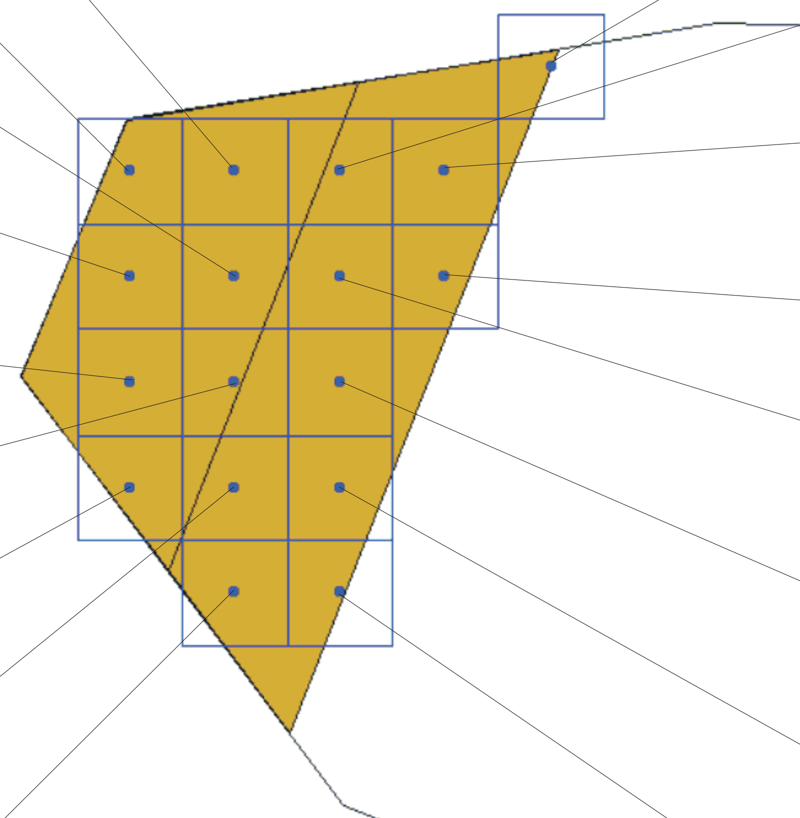
Figure B-11

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

Combat Pistol Range
Lead Results by Method 7420
(mg/Kg)



S15230312C	19.8
S15230312N	14.2
S15230312S	27.6
S15230312E	20.3
S15230312W	12.5

S15130312C	14.4
S15130312N	14.9
S15130312S	23.2
S15130312E	13.4
S15130312W	22.9

S15030313C	46.1
S15030313N	17.2
S15030313S	16.8
S15030313E	29.5
S15030313W	33.1

S14930312C	29.6
S14930312N	15.5
S14930312S	81.8
S14930312E	165
S14930312W	58.5

S14730312C	16.0
S14730312N	39.5
S14730312S	16.3
S14730312E	24.1
S14730312W	31.7

S14830313C	16.2
S14830313N	15.9
S14830313S	15.7
S14830313E	43.0
S14830313W	15.9

S14630313C	17.2
S14630313N	15.5
S14630313S	23.3
S14630313E	16.7
S14630313W	33.3

S15530313C	16.4
S15530313N	12.2
S15530313S	20.5
S15530313E	13.5
S15530313W	15.3

S15330313C	12.0
S15330313N	12.6
S15330313S	10.1
S15330313E	12.7
S15330313W	11.2

S16230313C	12.3
S16230313N	9.2
S16230313S	12.2
S16230313E	9.3
S16230313W	12.8

S16030313C	11.5
S16030313N	12.0
S16030313S	19.5
S16030313E	17.0
S16030313W	785

S16130313C	11.5
S16130313N	39.3
S16130313S	9.5
S16130313E	11.4
S16130313W	11.3

S15930313C	18.1
S15930313N	54.0
S15930313S	22.2
S15930313E	16.9
S15930313W	11.3

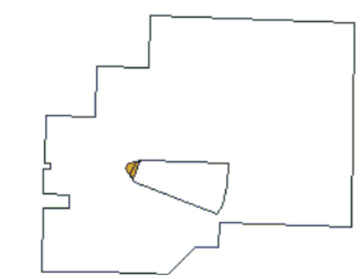
S15830313C	21.4
S15830313N	25.3
S15830313S	24.2
S15830313E	35.5
S15830313W	116

S15730313C	23.8
S15730313N	27.6
S15730313S	14.4
S15730313E	20.5
S15730313W	35.5

S15630313C	13.1
S15630313N	14.3
S15630313S	15.2
S15630313E	14.1
S15630313W	15.9

S15430313C	11.0
S15430313N	17.7
S15430313S	10.2
S15430313E	12.3
S15430313W	8.7

Key Map



Legend

- Sampling Grid
- Sampling Grid Center Points
  - Combat Pistol Range
  - Combat Pistol Range (drop zone)
- Range Fan
- Range Footprint
  - Combat Pistol Range

N
W E
S

200 0 200 400 Feet

August 15, 2003

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Figure B-12

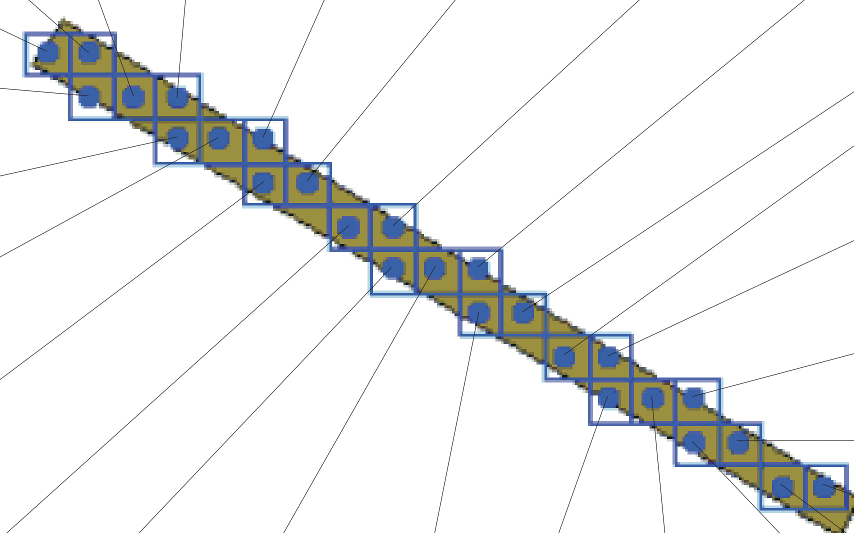
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Machine Gun South
Lead Results by Method 7420
(mg/Kg)



S18530318C	20.9
S18530318N	18.2
S18530318S	15.0
S18530318E	14.2
S18530318W	14.0

S18630318C	20.1
S18630318N	14.6
S18630318S	18.1
S18630318E	423
S18630318W	19.4

S18330318C	17.0
S18330318N	81.0
S18330318S	18.1
S18330318E	13.8
S18330318W	18.8

S18030318C	13.1
S18030318N	14.3
S18030318S	17.8
S18030318E	15.0
S18030318W	21.1

S17830318C	10.6
S17830318N	9.1
S17830318S	5.2
S17830318E	6.9
S17830318W	14.5

S17630318C	10.3
S17630318N	12.0
S17630318S	10.3
S17630318E	11.7
S17630318W	12.0

S17330318C	10.9
S17330318N	14.6
S17330318S	11.9
S17330318E	9.8
S17330318W	7.7

S17030318C	16.3
S17030318N	12.9
S17030318S	12.4
S17030318E	14.9
S17030318W	19.1

S17130318C	12.9
S17130318N	12.9
S17130318S	16.9
S17130318E	14.9
S17130318W	13.6

S16930317C	8.9
S16930317N	9.9
S16930317S	14.0
S16930317E	10.3
S16930317W	22.0

S16630317C	6.9
S16630317N	9.8
S16630317S	12.9
S16630317E	7.4
S16630317W	6.9

S16430317C	21.2
S16430317N	12.0
S16430317S	14.5
S16430317E	13.1
S16430317W	10.7

S16330317C	8.0
S16330317N	19.5
S16330317S	8.0
S16330317E	8.8
S16330317W	8.5

S16530317C	14.4
S16530317N	10.7
S16530317S	17.7
S16530317E	13.5
S16530317W	14.2

S18830318C	19.0
S18830318N	19.6
S18830318S	13.5
S18830318E	16.4
S18830318W	14.8

S18730318C	13.4
S18730318N	18.9
S18730318S	18.5
S18730318E	19.9
S18730318W	16.4

S18430318C	19.5
S18430318N	15.2
S18430318S	24.1
S18430318E	20.4
S18430318W	13.1

S18130318C	13.1
S18130318N	27.8
S18130318S	15.6
S18130318E	12.7
S18130318W	15.9

S18230318C	13.1
S18230318N	14.1
S18230318S	11.6
S18230318E	16.9
S18230318W	20.9

S17930318C	13.4
S17930318N	9.8
S17930318S	12.1
S17930318E	14.5
S17930318W	18.6

S17730318C	11.5
S17730318N	11.5
S17730318S	10.0
S17730318E	11.5
S17730318W	10.7

S17430318C	10.7
S17430318N	14.4
S17430318S	28.8
S17430318E	19.2
S17430318W	10.3

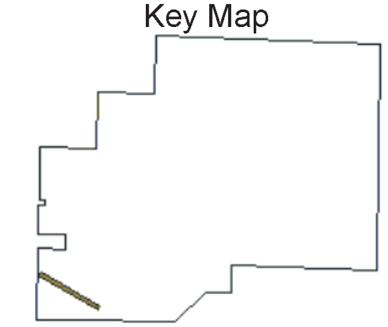
S17530318C	18.1
S17530318N	12.7
S17530318S	12.9
S17530318E	12.1
S17530318W	11.8

S17230318C	11.4
S17230318N	11.4
S17230318S	10.6
S17230318E	11.9
S17230318W	12.0

S16730317C	21.8
S16730317N	12.3
S16730317S	17.2
S16730317E	135
S16730317W	16.1

S16830317C	24.1
S16830317N	16.5
S16830317S	31.5
S16830317E	27.0
S16830317W	18.8

Key Map



Legend

Sampling Grid

Sampling Grid Center Points

Range Footprint

Machine Gun South

N W E S

200 0 200 400 600 Feet

August 15, 2003

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Figure B-13

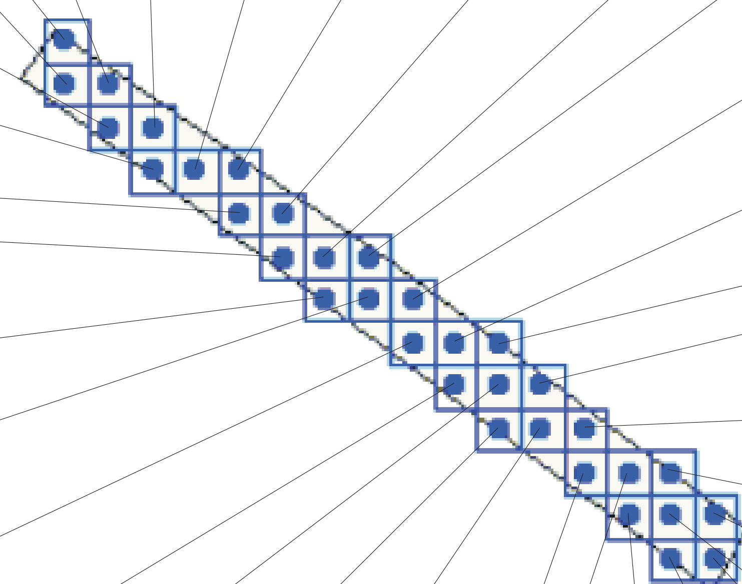
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Machine Gun North
Lead Results by Method 7420
(mg/Kg)



S22130311C	72.8
S22130311N	36.4
S22130311S	22.0
S22130311E	38.3
S22130311W	86.2

S22030311C	39.6
S22030311N	19.6
S22030311S	42.4
S22030311E	21.2
S22030311W	40.9

S21830311C	15.1
S21830311N	25.2
S21830311S	26.4
S21830311E	23.6
S21830311W	15.6

S21530311C	22.1
S21530311N	20.3
S21530311S	13.4
S21530311E	18.9
S21530311W	20.6

S21630311C	21.1
S21630311N	11.7
S21630311S	18.5
S21630311E	15.8
S21630311W	18.2

S21330311C	19.8
S21330311N	16.0
S21330311S	18.1
S21330311E	19.0
S21330311W	23.7

S21030311C	18.8
S21030311N	17.5
S21030311S	20.5
S21030311E	21.0
S21030311W	17.6

S21930311C	38.3
S21930311N	30.5
S21930311S	107
S21930311E	39.2
S21930311W	53.2

S21730311C	15.5
S21730311N	16.8
S21730311S	32.9
S21730311E	13.6
S21730311W	21.0

S21430311C	18.9
S21430311N	25.4
S21430311S	22.1
S21430311E	26.0
S21430311W	22.7

S21230311C	21.2
S21230311N	20.8
S21230311S	20.1
S21230311E	22.9
S21230311W	15.7

S20930311C	22.8
S20930311N	23.6
S20930311S	23.6
S20930311E	14.1
S20930311W	22.5

S20630311C	19.6
S20630311N	26.7
S20630311S	17.8
S20630311E	20.0
S20630311W	18.9

S20730311C	15.9
S20730311N	13.4
S20730311S	22.5
S20730311E	34.9
S20730311W	22.0

S20330307C	16.5
S20330307N	20.0
S20330307S	12.3
S20330307E	30.3
S20330307W	15.3

S20030307C	14.2
S20030307N	12.2
S20030307S	10.5
S20030307E	13.2
S20030307W	15.6

S20130307C	23.0
S20130307N	13.6
S20130307S	9.6
S20130307E	7.0
S20130307W	< 5.7

S19730311C	6.7
S19730311N	10.4
S19730311S	12.9
S19730311E	6.1
S19730311W	18.7

S19830307C	13.9
S19830307N	12.5
S19830307S	10.2
S19830307E	10.8
S19830307W	27.5

S19430307C	16.1
S19430307N	21.5
S19430307S	11.5
S19430307E	24.6
S19430307W	14.7

S19530307C	18.0
S19530307N	44.6
S19530307S	31.0
S19530307E	13.6
S19530307W	25.9

S19130311C	54.7
S19130311N	25.7
S19130311S	19.3
S19130311E	17.8
S19130311W	17.8

S18930311C	63.4
S18930311N	37.8
S18930311S	26.5
S18930311E	59.1
S18930311W	26.6

S19030311C	25.5
S19030311N	20.2
S19030311S	18.1
S19030311E	22.7
S19030311W	18.8

S19230311C	14.4
S19230311N	23.3
S19230311S	14.2
S19230311E	15.5
S19230311W	25.9

S19330311C	11.9
S19330311N	17.1
S19330311S	16.8
S19330311E	20.7
S19330311W	22.1

S19630311C	158
S19630311N	31.8
S19630311S	14.4
S19630311E	18.7
S19630311W	50.2

S19930307C	17.5
S19930307N	24.4
S19930307S	18.4
S19930307E	17.8
S19930307W	13.7

S20230307C	13.8
S20230307N	10.4
S20230307S	11.6
S20230307E	20.8
S20230307W	11.9

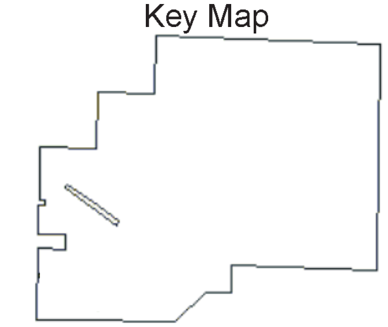
S20530311C	13.4
S20530311N	7.6
S20530311S	62.8
S20530311E	19.5
S20530311W	52.2

S20430307C	12.9
S20430307N	22.9
S20430307S	12.1
S20430307E	10.3
S20430307W	16.1

S20830307C	13.2
S20830307N	12.8
S20830307S	12.0
S20830307E	12.0
S20830307W	11.7

S21130311C	15.3
S21130311N	23.2
S21130311S	13.5
S21130311E	19.8
S21130311W	16.6

Key Map



Legend

Sampling Grid

Sampling Grid Center Points

Range Footprint

Machine Gun North

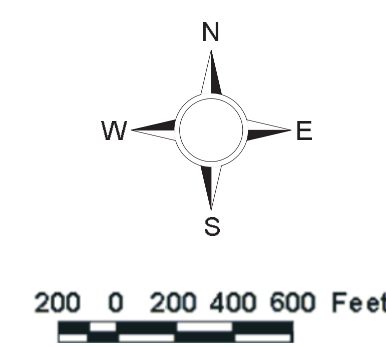


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Figure B-14

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

M31 Sub-Caliber Ranges 1&2 Lead Results by Method 7420 (mg/Kg)

S24530319C	7.5
S24530319N	7.9
S24530319S	10.7
S24530319E	11.4
S24530319W	11.9

S24330319C	7.5
S24330319N	10.7
S24330319S	11.4
S24330319E	< 5.2
S24330319W	10.3

S24030319C	10.4
S24030319N	5.4
S24030319S	8.8
S24030319E	8.0
S24030319W	8.9

S23930319C	11.0
S23930319N	13.6
S23930319S	9.9
S23930319E	12.1
S23930319W	10.9

S23730319C	< 5.4
S23730319N	12.1
S23730319S	< 4.9
S23730319E	18.5
S23730319W	< 5.9

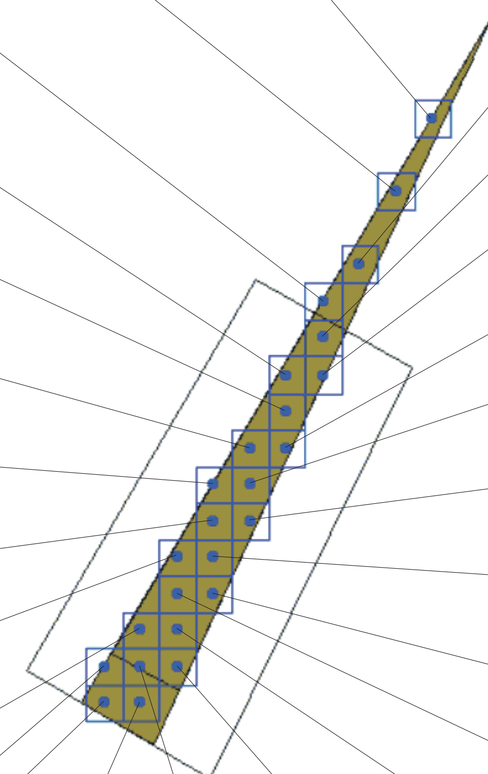
S23530320C	10.3
S23530320N	13.3
S23530320S	9.1
S23530320E	< 5.0
S23530320W	9.6

S23330320C	11.3
S23330320N	6.6
S23330320S	16.6
S23330320E	20.3
S23330320W	< 4.7

S23130320C	12.5
S23130320N	12.0
S23130320S	11.6
S23130320E	11.3
S23130320W	10.5

S22730319C	11.9
S22730319N	11.2
S22730319S	7.8
S22730319E	11.7
S22730319W	8.8

S24630318C	15.4
S24630318N	10.5
S24630318S	8.2
S24630318E	16.9
S24630318W	8.9



S24430319C	11.9
S24430319N	13.6
S24430319S	13.8
S24430319E	13.3
S24430319W	13.5

S24230319C	9.7
S24230319N	13.8
S24230319S	15.1
S24230319E	11.3
S24230319W	8.5

S24130319C	9.9
S24130319N	8.1
S24130319S	9.1
S24130319E	13.0
S24130319W	8.0

S23830319C	11.5
S23830319N	12.4
S23830319S	10.3
S23830319E	12.6
S23830319W	10.2

S23630319C	20.5
S23630319N	11.2
S23630319S	14.6
S23630319E	11.5
S23630319W	14.0

S23430319C	12.4
S23430319N	15.4
S23430319S	17.7
S23430319E	14.3
S23430319W	14.5

S23230320C	12.5
S23230320N	11.2
S23230320S	12.6
S23230320E	12.1
S23230320W	8.8

S23030320C	16.2
S23030320N	11.1
S23030320S	13.3
S23030320E	10.3
S23030320W	8.2

S22930320C	10.1
S22930320N	12.7
S22930320S	18.2
S22930320E	16.6
S22930320W	14.2

S22430319C	11.9
S22430319N	12.4
S22430319S	14.1
S22430319E	51.3
S22430319W	12.8

S22230319C	11.6
S22230319N	14.1
S22230319S	8.4
S22230319E	10.3
S22230319W	20.5

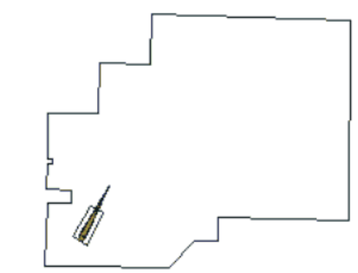
S22330319C	18.3
S22330319N	8.5
S22330319S	9.5
S22330319E	8.1
S22330319W	5.5

S22530319C	17.0
S22530319N	14.5
S22530319S	10.1
S22530319E	15.5
S22530319W	9.5

S22630319C	18.9
S22630319N	15.5
S22630319S	13.8
S22630319E	16.8
S22630319W	17.8

S22830320C	11.9
S22830320N	12.3
S22830320S	11.6
S22830320E	11.3
S22830320W	10.0

Key Map



Legend

Sampling Grid
Sampling Grid Center Points
Sub-caliber Artillery 1
Range Fan
Range Footprint
Sub-caliber Artillery

N
W E
S

400 0 400 800 Feet

August 15, 2003

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Figure B-15

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

25 Meter and Machine Gun Range
Lead Results by Method 7420
(mg/Kg)

S25830306C	13.8
S25830306N	10.6
S25830306S	25.0
S25830306E	6.1
S25830306W	9.8

S25530306C	204
S25530306N	64.3
S25530306S	62.1
S25530306E	24.7
S25530306W	10.8

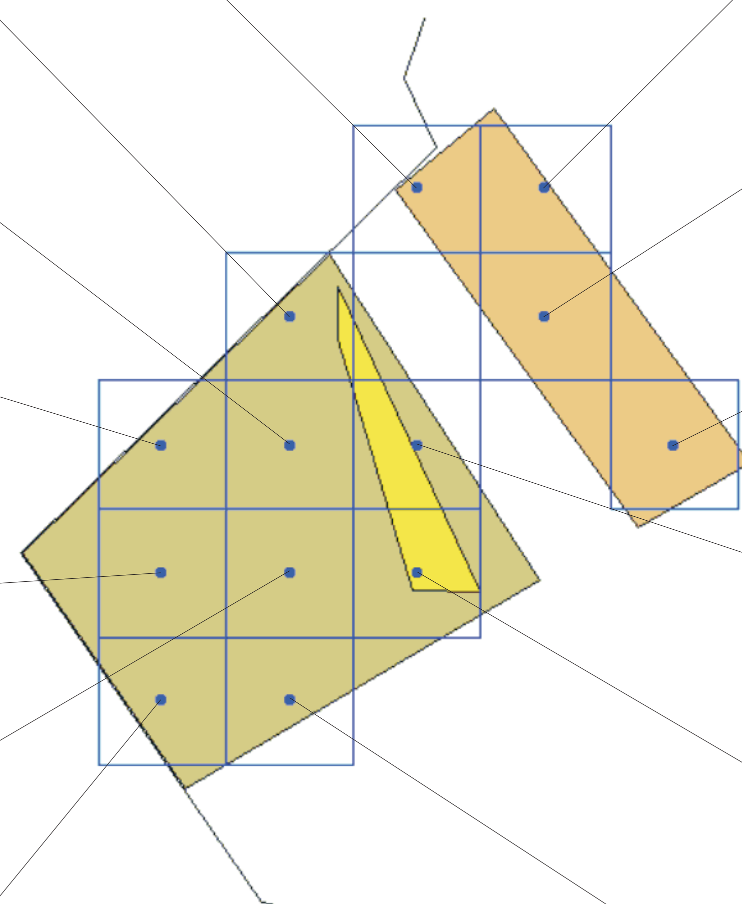
S25330306C	45.4
S25330306N	31.6
S25330306S	126
S25330306E	5.7
S25330306W	11.4

S25230306C	85.9
S25230306N	42.7
S25230306S	25.1
S25230306E	28.5
S25230306W	37.6

S24930306C	31.1
S24930306N	19.1
S24930306S	29.3
S24930306E	17.2
S24930306W	18.2

S25030306C	27.0
S25030306N	17.2
S25030306S	25.2
S25030306E	31.7
S25030306W	12.2

S24730306C	12.0
S24730306N	10.9
S24730306S	13.7
S24730306E	14.6
S24730306W	116



S25930306C	7.6
S25930306N	25.5
S25930306S	33.8
S25930306E	11.0
S25930306W	5.5

S25730306C	38.2
S25730306N	708
S25730306S	13.0
S25730306E	37.6
S25730306W	114

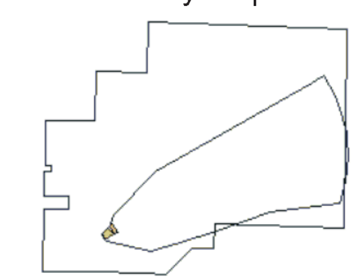
S25630306C	120
S25630306N	75.3
S25630306S	40.4
S25630306E	105
S25630306W	64.0

S25430306C	26300
S25430306N	1330
S25430306S	964
S25430306E	429
S25430306W	4550

S25130306C	214
S25130306N	2180
S25130306S	49.1
S25130306E	61.0
S25130306W	66.6

S24830306C	16.2
S24830306N	19.0
S24830306S	43.6
S24830306E	22.7
S24830306W	9.6

Key Map



Legend

- Sampling Grid
- Sampling Grid Center Points
  - 25M Range, Machine Gun Range
  - 25M Range, Machine Gun Range (drop zone)
- Berm
- Range Fan
- Range Footprint
  - 25M Range, Machine Gun Range
  - 25M Range, Machine Gun Range (drop zone)

N W E S

100 0 100 200 300 Feet

August 15, 2003

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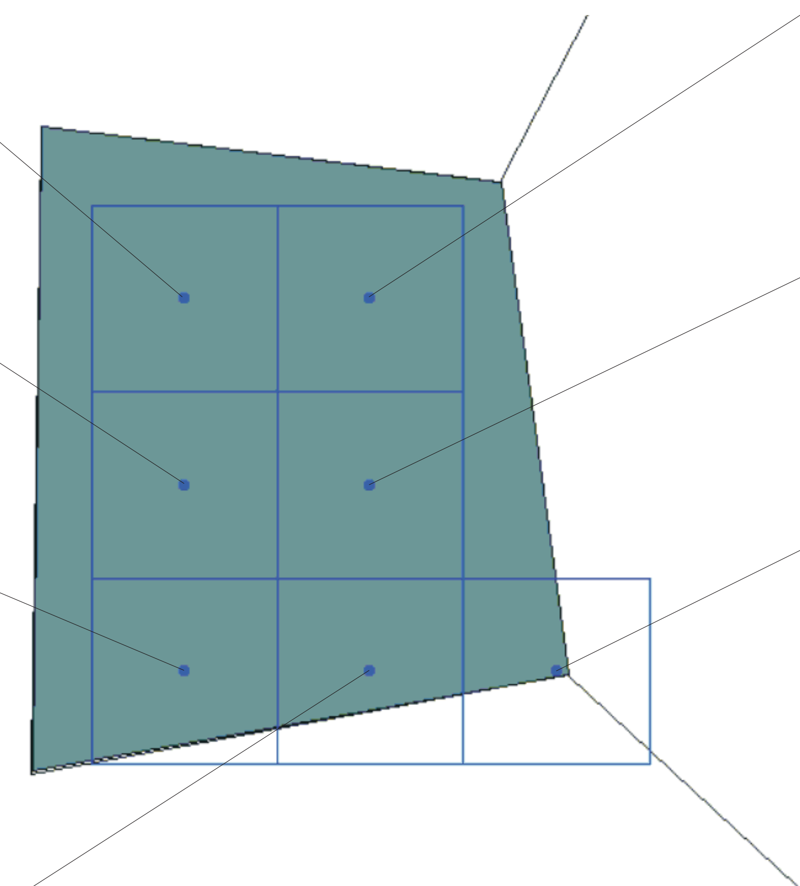
S26530306C	14.1
S26530306N	13.4
S26530306S	13.8
S26530306E	14.8
S26530306W	13.4

S26330306C	5.6
S26330306N	9.4
S26330306S	10.4
S26330306E	105
S26330306W	17.9

S26030306C	14.7
S26030306N	16.1
S26030306S	15.8
S26030306E	11.1
S26030306W	151

S26130306C	23.6
S26130306N	17.5
S26130306S	15.6
S26130306E	14.6
S26130306W	14.5



S26630306C	17.1
S26630306N	15.9
S26630306S	23.9
S26630306E	20.7
S26630306W	15.7

S26430306C	10.0
S26430306N	12.9
S26430306S	19.1
S26430306E	10.5
S26430306W	10.0

S26230306C	15.4
S26230306N	47.6
S26230306S	18.2
S26230306E	11.0
S26230306W	16.1

Figure B-16

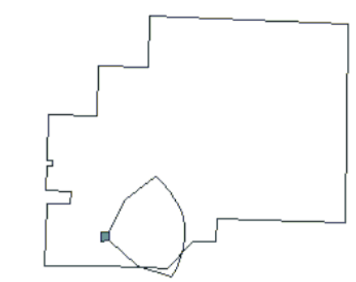
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

Infiltration Course South Lead Results by Method 7420 (mg/Kg)

Key Map



Legend

Sampling Grid
Sampling Grid Center Points
Infiltration Course 2
Range Fan
Range Footprint
Infiltration Course 2

N
W E
S

100 0 100 200 Feet

August 15, 2003

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S29530314C	21.0
S29530314N	18.5
S29530314S	26.0
S29530314E	32.8
S29530314W	11.4

S29630314C	163
S29630314N	76.5
S29630314S	27.3
S29630314E	33.9
S29630314W	51.0

S29930314C	94.9
S29930314N	647
S29930314S	34.6
S29930314E	19.9
S29930314W	107

S29730314C	31.7
S29730314N	24.8
S29730314S	30.6
S29730314E	23.0
S29730314W	19.5

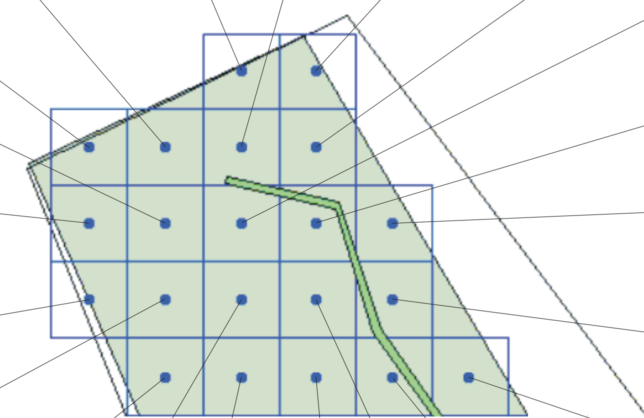
S30030314C	150
S30030314N	45.3
S30030314S	238
S30030314E	296
S30030314W	8880

S29830314C	10.5
S29830314N	20.5
S29830314S	16.2
S29830314E	13.6
S29830314W	23.8

S29230315C	9.7
S29230315N	14.4
S29230315S	78.4
S29230315E	18.5
S29230315W	13.2

S29330315C	10.7
S29330315N	14.1
S29330315S	14.8
S29330315E	11.9
S29330315W	9.7

S29130315C	44.3
S29130315N	14.1
S29130315S	24.3
S29130315E	25.5
S29130315W	33.7



S29430315C	11.2
S29430315N	19.2
S29430315S	13.8
S29430315E	11.5
S29430315W	12.5

S29030315C	26.3
S29030315N	23.2
S29030315S	22.8
S29030315E	13.5
S29030315W	88.2

S28930315C	11.0
S28930315N	11.6
S28930315S	14.0
S28930315E	13.6
S28930315W	10.7

S28530315C	13.2
S28530315N	77.5
S28530315S	44.9
S28530315E	90.3
S28530315W	84.5

S28430315C	11.8
S28430315N	12.0
S28430315S	9.3
S28430315E	8.9
S28430315W	10.9

S28630315C	13.6
S28630315N	22.7
S28630315S	17.5
S28630315E	31.7
S28630315W	25.9

S28030315C	11.9
S28030315N	15.2
S28030315S	22.9
S28030315E	11.5
S28030315W	13.9

S28730315C	18.2
S28730315N	18.6
S28730315S	10.0
S28730315E	12.9
S28730315W	23.6

S28130315C	13.8
S28130315N	19.9
S28130315S	15.7
S28130315E	10.3
S28130315W	13.8

S28230315C	5.9
S28230315N	12.4
S28230315S	9.3
S28230315E	6.7
S28230315W	5.4

S28830315C	11.5
S28830315N	13.2
S28830315S	12.0
S28830315E	15.2
S28830315W	12.3

S28330315C	12.7
S28330315N	12.5
S28330315S	11.7
S28330315E	9.0
S28330315W	11.4

Figure B-17a

Camp Bonneville

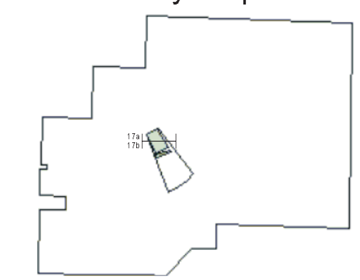
Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

25M Record Fire Field Range
Field Firing Range
Lead Results by Method 7420
(mg/Kg)

Key Map



Legend

- Berms.shp
- Grid_centerpoint_dz.shp
- Centerpoint_polygons.shp
- Ranges_smallarms.shp

Footprints.shp

- 25M Range, Record Firing Range, Field Firing Range

N

W E

S

200 0 200 400 600 Feet

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Figure B-17b

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

25M Record Fire Field Range
Field Firing Range
Lead Results by Method 7420
(mg/Kg)

S27430315C	14.3
S27430315N	9.1
S27430315S	19.3
S27430315E	12.9
S27430315W	9.3

S27530315C	9.6
S27530315N	6.6
S27530315S	13.9
S27530315E	55.2
S27530315W	11.2

S27630315C	8.8
S27630315N	12.0
S27630315S	8.8
S27630315E	8.5
S27630315W	9.8

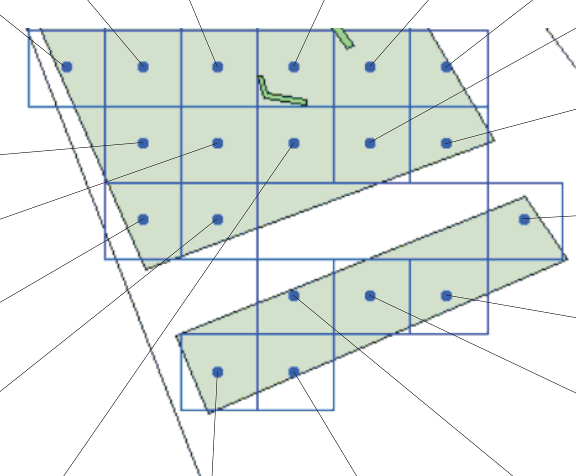
S27730315C	20.8
S27730315N	11.3
S27730315S	9.0
S27730315E	6.8
S27730315W	8.0

S27830315C	< 4.8
S27830315N	10.6
S27830315S	10.4
S27830315E	25.3
S27830315W	5.2

S27930315C	12.1
S27930315N	7.6
S27930315S	21.5
S27930315E	12.1
S27930315W	12.4

S27230317C	8.1
S27230317N	12.7
S27230317S	10.4
S27230317E	10.9
S27230317W	11.5

S27330317C	13.0
S27330317N	9.5
S27330317S	10.5
S27330317E	9.3
S27330317W	10.5



S26930317C	7.6
S26930317N	13.2
S26930317S	10.3
S26930317E	10.5
S26930317W	8.2

S30630317C	8.5
S30630317N	9.9
S30630317S	7.4
S30630317E	9.1
S30630317W	11.1

S27030317C	14.2
S27030317N	10.2
S27030317S	12.2
S27030317E	8.7
S27030317W	10.5

S30530317C	12.8
S30530317N	10.1
S30530317S	10.9
S30530317E	11.6
S30530317W	41.5

S26730317C	11.9
S26730317N	8.3
S26730317S	9.7
S26730317E	8.9
S26730317W	7.7

S30430317C	8.7
S30430317N	7.2
S30430317S	7.2
S30430317E	19.0
S30430317W	8.5

S26830317C	11.8
S26830317N	7.7
S26830317S	9.1
S26830317E	11.0
S26830317W	8.8

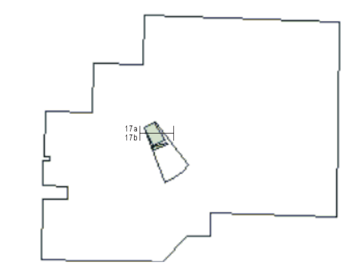
S27130317C	12.9
S27130317N	21.0
S27130317S	15.9
S27130317E	11.9
S27130317W	7.4

S30130317C	12.9
S30130317N	12.3
S30130317S	16.3
S30130317E	13.7
S30130317W	8.5

S30230317C	8.0
S30230317N	10.0
S30230317S	12.9
S30230317E	12.6
S30230317W	8.7

S30330317C	12.8
S30330317N	12.6
S30330317S	7.5
S30330317E	10.3
S30330317W	10.2

Key Map



Legend

- Berms.shp
- Grid_centerpoint_dz.shp
- Centerpoint_polygons.shp
- Ranges_smallarms.shp

Footprints.shp

- 25M Range, Record Firing Range, Field Firing Range

N

W E

S

200 0 200 400 600 Feet

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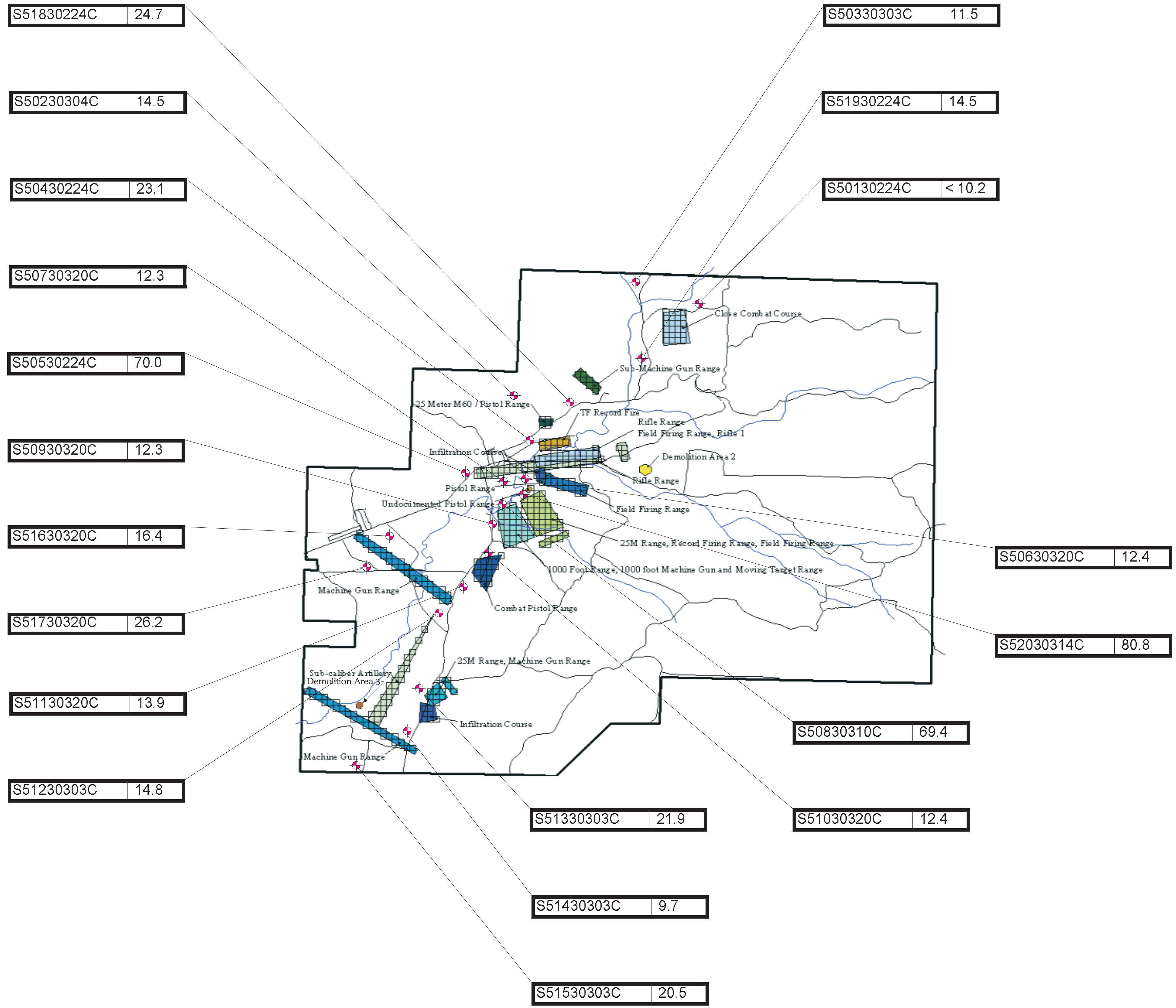

Figure B-18

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Background Lead Results by Method 7420 (mg/Kg)

Legend

- Creeks
- Roads
- Sampling Grid
- Demolition Area 2
- Demolition Area 3

Range Sampling Areas

- 1000 Foot Range, 1000 foot Machine Gun and Moving Target Range
- 25 Meter M60 / Pistol Range
- 25M Range, Machine Gun Range
- 25M Range, Record Firing Range, Field Firing Range
- Close Combat Course
- Combat Pistol Range
- Field Firing Range
- Field Firing Range, Rifle 1
- Infiltration Course
- Machine Gun Range
- Pistol Range
- Rifle Range
- Sub-Machine Gun Range
- Sub-caliber Artillery
- TF Record Fire
- Undocumented Pistol Range
- Site Boundary

Background Sample Location

N
W E
S

0.5 0 0.5 1 Miles

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S60330304C

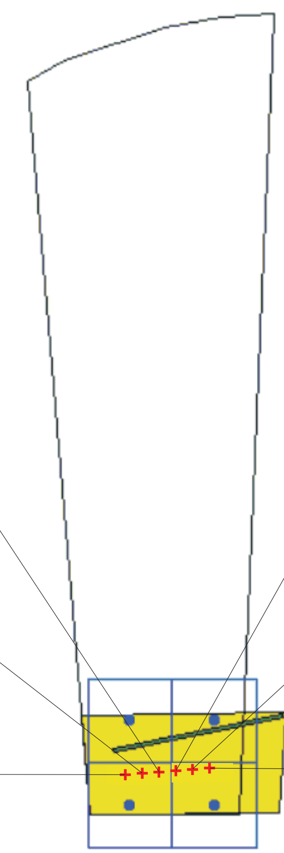
HMX	< 2.6
RDX	< 2.6
1,3,5-TNB	< 2.6
1,3-DNB	< 2.6
2,4,6-TNT	< 2.6
NB	< 2.6
2,4,6-TNT	< 2.6
4-Am-DNT	< 2.6
2-Am-DNT	< 2.6
2,4-DNT	< 2.6
2,6-DNT	< 2.6
2-NT	< 2.6
3-NT	< 2.6
4-NT	< 2.6
Picric Acid	< 10
PETN	< 13

S60230304C

HMX	< 2.5
RDX	< 2.5
1,3,5-TNB	< 2.5
1,3-DNB	< 2.5
Tetryl	< 2.5
NB	< 2.5
2,4,6-TNT	< 2.5
4-Am-DNT	< 2.5
2-Am-DNT	< 2.5
2,4-DNT	< 2.5
2,6-DNT	< 2.5
2-NT	< 2.5
3-NT	< 2.5
4-NT	< 2.5
Picric Acid	< 10
PETN	< 13

S60130304C

HMX	< 2.7
RDX	< 2.7
1,3,5-TNB	< 2.7
1,3-DNB	< 2.7
Tetryl	< 2.7
NB	< 2.7
2,4,6-TNT	< 2.7
4-Am-DNT	< 2.7
2-Am-DNT	< 2.7
2,4-DNT	< 2.7
2,6-DNT	< 2.7
2-NT	< 2.7
3-NT	< 2.7
4-NT	< 2.7
Picric Acid	< 10
PETN	< 14



S60430304C

HMX	< 3.2
RDX	< 3.2
1,3,5-TNB	< 3.2
1,3-DNB	< 3.2
Tetryl	< 3.2
NB	< 3.2
2,4,6-TNT	< 3.2
4-Am-DNT	< 3.2
2-Am-DNT	< 3.2
2,4-DNT	< 3.2
2,6-DNT	< 3.2
2-NT	< 3.2
3-NT	< 3.2
4-NT	< 3.2
Picric Acid	< 10
PETN	< 16

S60530304C

HMX	< 2.8
RDX	< 2.8
1,3,5-TNB	< 2.8
1,3-DNB	< 2.8
Tetryl	< 2.8
NB	< 2.8
2,4,6-TNT	< 2.8
4-Am-DNT	< 2.8
2-Am-DNT	< 2.8
2,4-DNT	< 2.8
2,6-DNT	< 2.8
2-NT	< 2.8
3-NT	< 2.8
4-NT	< 2.8
Picric Acid	< 10
PETN	< 14

S60630304C

HMX	< 3.0
RDX	< 3.0
1,3,5-TNB	< 3.0
1,3-DNB	< 3.0
Tetryl	< 3.0
NB	< 3.0
2,4,6-TNT	< 3.0
4-Am-DNT	< 3.0
2-Am-DNT	< 3.0
2,4-DNT	< 3.0
2,6-DNT	< 3.0
2-NT	< 3.0
3-NT	< 3.0
4-NT	< 3.0
Picric Acid	< 10
PETN	< 15

Figure B-19

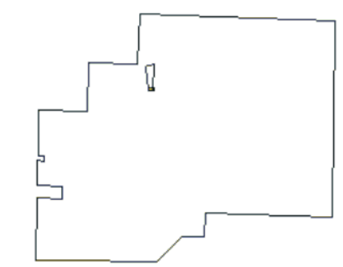
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

25 Meter M60 Range/ Pistol Range Muzzle Blast Zone Samples (mg/Kg)

Key Map

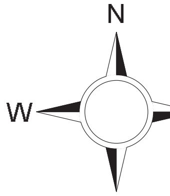


Legend

- Sampling Grid
- Sampling Grid Center Points
- Muzzle Blast Zone Sample Points
- Berm
- Range Fan

Range Footprint

- 25 Meter M60 / Pistol Range



100 0 100 200 300 Feet

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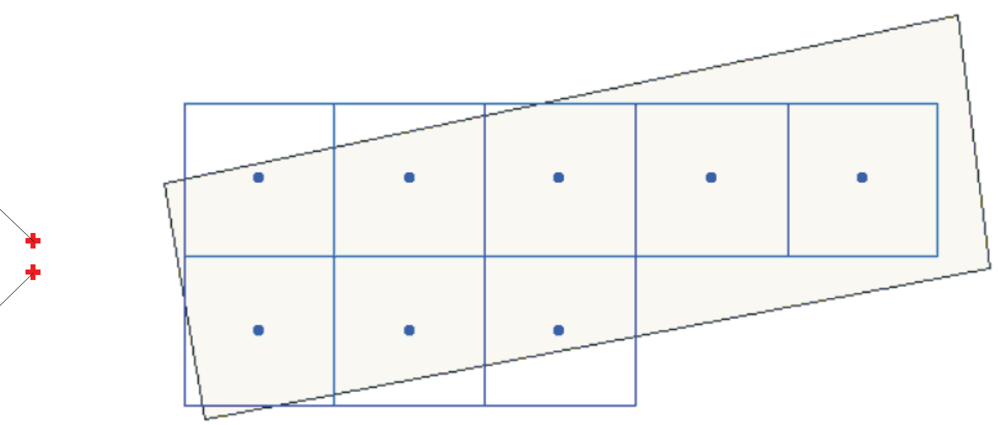
S60730307C

HMX	< 2.6
RDX	< 2.6
1,3,5-TNB	< 2.6
1,3-DNB	< 2.6
Tetryl	< 2.6
NB	< 2.6
2,4,6-TNT	< 2.6
4-Am-DNT	< 2.6
2-Am-DNT	< 2.6
2,4-DNT	< 2.6
2,6-DNT	< 2.6
2-NT	< 2.6
3-NT	< 2.6
4-NT	< 2.6
Picric Acid	< 10
PETN	< 13



S60830307C

HMX	< 3.0
RDX	< 3.0
1,3,5-TNB	< 3.0
1,3-DNB	< 3.0
Tetryl	< 3.0
NB	< 3.0
2,4,6-TNT	< 3.0
4-Am-DNT	< 3.0
2-Am-DNT	< 3.0
2,4-DNT	< 3.0
2,6-DNT	< 3.0
2-NT	< 3.0
3-NT	< 3.0
4-NT	< 3.0
Picric Acid	< 10
PETN	< 15

Figure B-20

Camp Bonneville

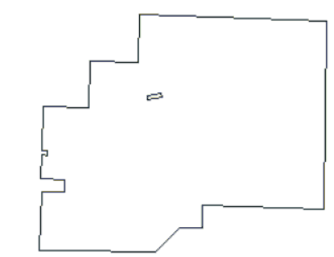
Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

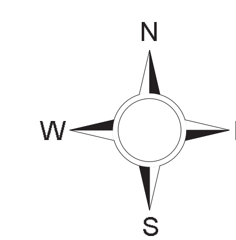
TF Range
Muzzle Blast Zone Samples
(mg/Kg)

Key Map



Legend

Sampling Grid
Sampling Grid Center Points
Muzzle Blast Zone Sample Points
TF Record Fire
Range Footprint
TF Record Fire



100 0 100 200 300 400 Feet

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S60930228C

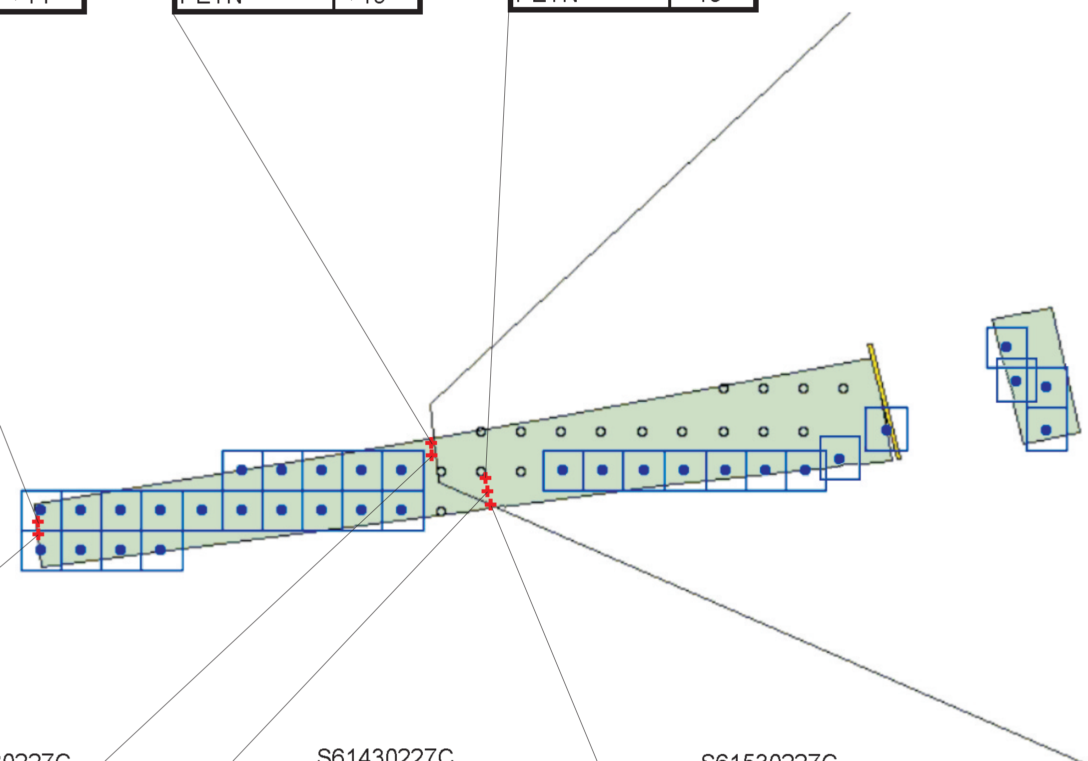
HMX	< 2.7
RDX	< 2.7
1,3,5-TNB	< 2.7
1,3-DNB	< 2.7
Tetryl	< 2.7
NB	< 2.7
2,4,6-TNT	< 2.7
4-Am-DNT	< 2.7
2-Am-DNT	< 2.7
2,4-DNT	< 2.7
2,6-DNT	< 2.7
2-NT	< 2.7
3-NT	< 2.7
4-NT	< 2.7
Picric Acid	< 10
PETN	< 14

S61130227C

HMX	< 2.9
RDX	< 2.9
1,3,5-TNB	< 2.9
1,3-DNB	< 2.9
Tetryl	< 2.9
NB	< 2.9
2,4,6-TNT	< 2.9
4-Am-DNT	< 2.9
2-Am-DNT	< 2.9
2,4-DNT	< 2.9
2,6-DNT	< 2.9
2-NT	< 2.9
3-NT	< 2.9
4-NT	< 2.9
Picric Acid	< 10
PETN	< 15

S61330227C

HMX	< 2.6
RDX	< 2.6
1,3,5-TNB	< 2.6
1,3-DNB	< 2.6
Tetryl	< 2.6
NB	< 2.6
2,4,6-TNT	< 2.6
4-Am-DNT	< 2.6
2-Am-DNT	< 2.6
2,4-DNT	< 2.6
2,6-DNT	< 2.6
2-NT	< 2.6
3-NT	< 2.6
4-NT	< 2.6
Picric Acid	< 10
PETN	< 13



S61030228C

HMX	< 3.1
RDX	< 3.1
1,3,5-TNB	< 3.1
1,3-DNB	< 3.1
Tetryl	< 3.1
NB	< 3.1
2,4,6-TNT	< 3.1
4-Am-DNT	< 3.1
2-Am-DNT	< 3.1
2,4-DNT	< 3.1
2,6-DNT	< 3.1
2-NT	< 3.1
3-NT	< 3.1
4-NT	< 3.1
Picric Acid	< 10
PETN	< 16

S61230227C

HMX	< 3.0
RDX	< 3.0
1,3,5-TNB	< 3.0
1,3-DNB	< 3.0
Tetryl	< 3.0
NB	< 3.0
2,4,6-TNT	< 3.0
4-Am-DNT	< 3.0
2-Am-DNT	< 3.0
2,4-DNT	< 3.0
2,6-DNT	< 3.0
2-NT	< 3.0
3-NT	< 3.0
4-NT	< 3.0
Picric Acid	< 10
PETN	< 15

S61430227C

HMX	< 2.6
RDX	< 2.6
1,3,5-TNB	< 2.6
1,3-DNB	< 2.6
Tetryl	< 2.6
NB	< 2.6
2,4,6-TNT	< 2.6
4-Am-DNT	< 2.6
2-Am-DNT	< 2.6
2,4-DNT	< 2.6
2,6-DNT	< 2.6
2-NT	< 2.6
3-NT	< 2.6
4-NT	< 2.6
Picric Acid	< 10
PETN	< 13

S61530227C

HMX	< 2.6
RDX	< 2.6
1,3,5-TNB	< 2.6
1,3-DNB	< 2.6
Tetryl	< 2.6
NB	< 2.6
2,4,6-TNT	< 2.6
4-Am-DNT	< 2.6
2-Am-DNT	< 2.6
2,4-DNT	< 2.6
2,6-DNT	< 2.6
2-NT	< 2.6
3-NT	< 2.6
4-NT	< 2.6
Picric Acid	< 10
PETN	< 13

Figure B-21

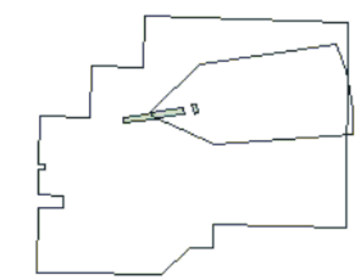
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

Rifle Ranges 1 and 2
Muzzle Blast Zone Samples
(mg/Kg)

Key Map



Legend

Sampling Grid
Sampling Grid Center Points
Field Firing Range, Rifle 1 & Rifle Range 1
Infiltration Course 1 & Rifle Range 1
Rifle Range 1
Rifle Range 1 (drop zone)
Muzzle Blast Zone Sample Points
Rifle Range 1
Berm
Range Fan
Range Footprint
Rifle Range

N
W E
S

300 0 300 600 900 Feet

August 15, 2003

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Figure B-22

Camp Bonneville

Vancouver, Washington

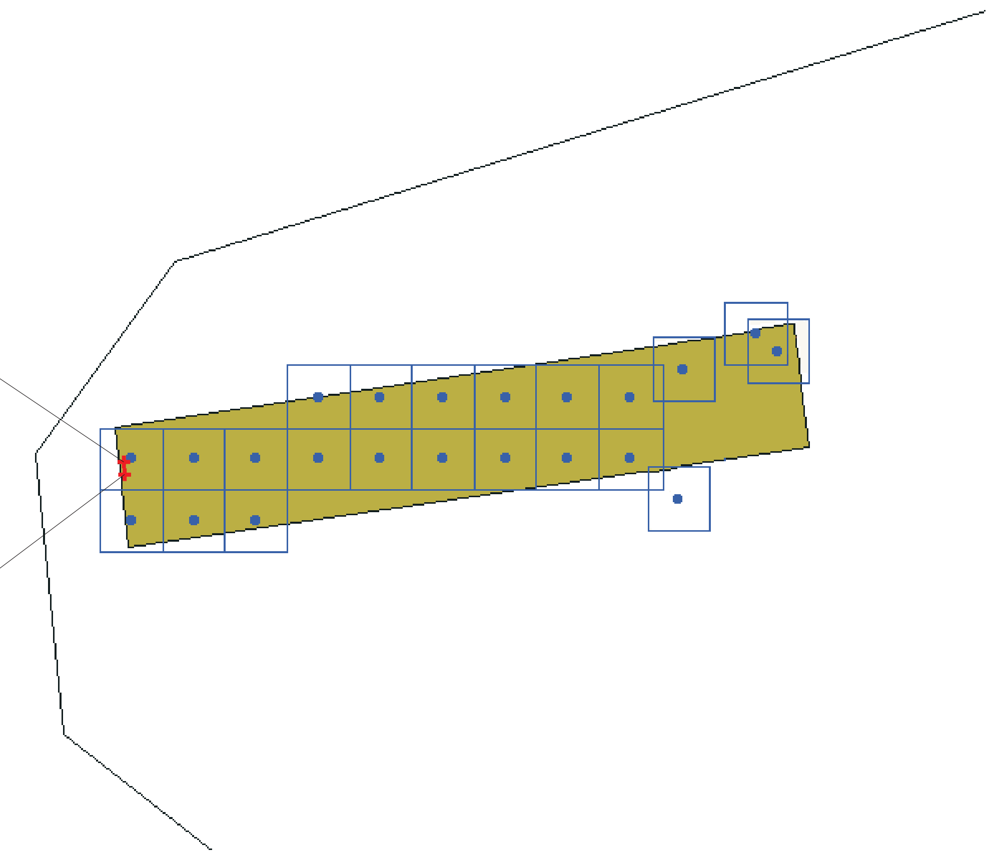
Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Field Fire Rifle Range 1 & 2
Muzzle Blast Zone Samples
(mg/Kg)

S61730228C

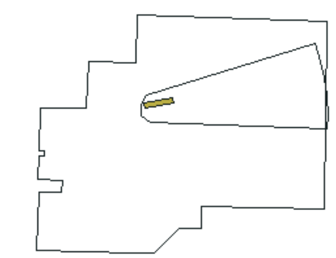
HMX	< 3.0
RDX	< 3.0
1,3,5-TNB	< 3.0
1,3-DNB	< 3.0
Tetryl	< 3.0
NB	< 3.0
2,4,6-TNT	< 3.0
4-Am-DNT	< 3.0
2-Am-DNT	< 3.0
2,4-DNT	< 3.0
2,6-DNT	< 3.0
2-NT	< 3.0
3-NT	< 3.0
4-NT	< 3.0
Picric Acid	< 10
PETN	< 15



S61630228C

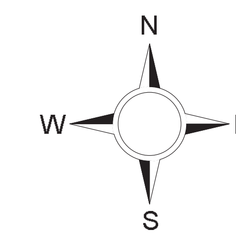
HMX	< 2.9
RDX	< 2.9
1,3,5-TNB	< 2.9
1,3-DNB	< 2.9
Tetryl	< 2.9
NB	< 2.9
2,4,6-TNT	< 2.9
4-Am-DNT	< 2.9
2-Am-DNT	< 2.9
2,4-DNT	< 2.9
2,6-DNT	< 2.9
2-NT	< 2.9
3-NT	< 2.9
4-NT	< 2.9
Picric Acid	< 10
PETN	< 15

Key Map



Legend

- Sampling Grid
- Sampling Grid Center Points
  - Field Firing Range, Rifle 1
  - Field Firing Range, Rifle 1 & Rifle Range 1
- Muzzle Blast Zone Sample Points
  - Field Fire Rifle Range 1
- Range Fan
- Range Footprint
  - Field Firing Range, Rifle 1



200 0 200 400 600 800 1000 Feet

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Figure B-23

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

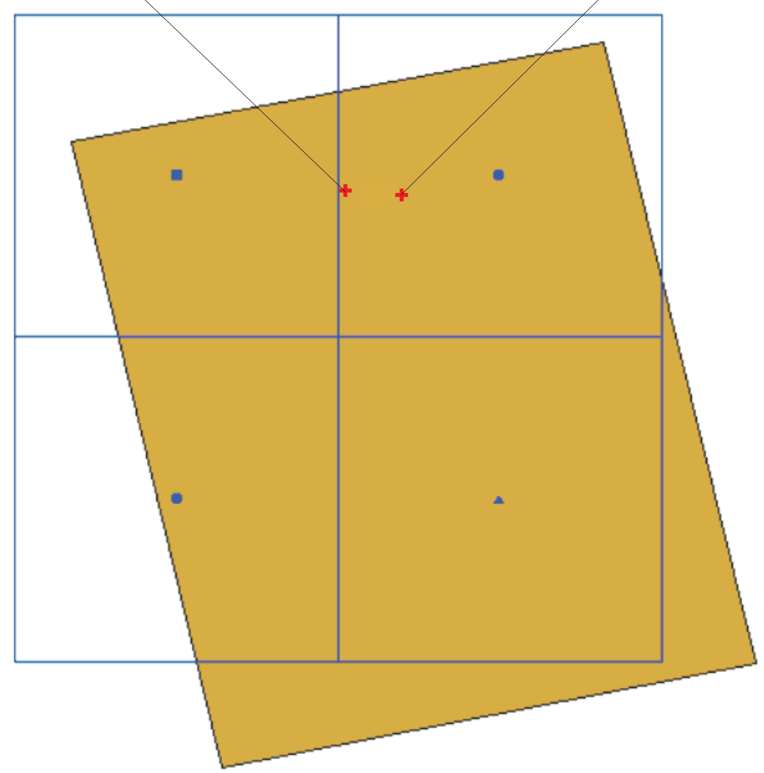
Infiltration Course North Muzzle Blast Zone Samples (mg/Kg)

S61830301C

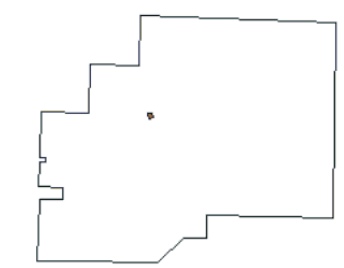
HMX	< 3.0
RDX	< 3.0
1,3,5-TNB	< 3.0
1,3-DNB	< 3.0
Tetryl	< 3.0
NB	< 3.0
2,4,6-TNT	< 3.0
4-Am-DNT	< 3.0
2-Am-DNT	< 3.0
2,4-DNT	< 3.0
2,6-DNT	< 3.0
2-NT	< 3.0
3-NT	< 3.0
4-NT	< 3.0
Picric Acid	< 10
PETN	< 15

S61930301C

HMX	< 2.4
RDX	< 2.4
1,3,5-TNB	< 2.4
1,3-DNB	< 2.4
Tetryl	< 2.4
NB	< 2.4
2,4,6-TNT	< 2.4
4-Am-DNT	< 2.4
2-Am-DNT	< 2.4
2,4-DNT	< 2.4
2,6-DNT	< 2.4
2-NT	< 2.4
3-NT	< 2.4
4-NT	< 2.4
Picric Acid	< 10
PETN	< 12



Key Map



Legend

Sampling Grid
Sampling Grid Center Points
- Infiltration Course 1
- Infiltration Course 1 & Pistol Range
- Infiltration Course 1 & Rifle Range 1

Muzzle Blast Zone Sample Points
- Infiltration Course North

Range Footprint
- Infiltration Course

N
W E
S

90 0 90 180 Feet

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Figure B-24

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Field Firing Ranges 1 & 2 and Undocumented Pistol Range Muzzle Blast Zone Samples (mg/Kg)

S62130317C	
HMX	< 2.5
RDX	< 2.5
1,3,5-TNB	< 2.5
1,3-DNB	< 2.5
Tetryl	< 2.5
NB	< 2.5
2,4,6-TNT	< 2.5
4-Am-DNT	< 2.5
2-Am-DNT	< 2.5
2,4-DNT	< 2.5
2,6-DNT	< 2.5
2-NT	< 2.5
3-NT	< 2.5
4-NT	< 2.5
Picric Acid	< 10
PETN	< 13

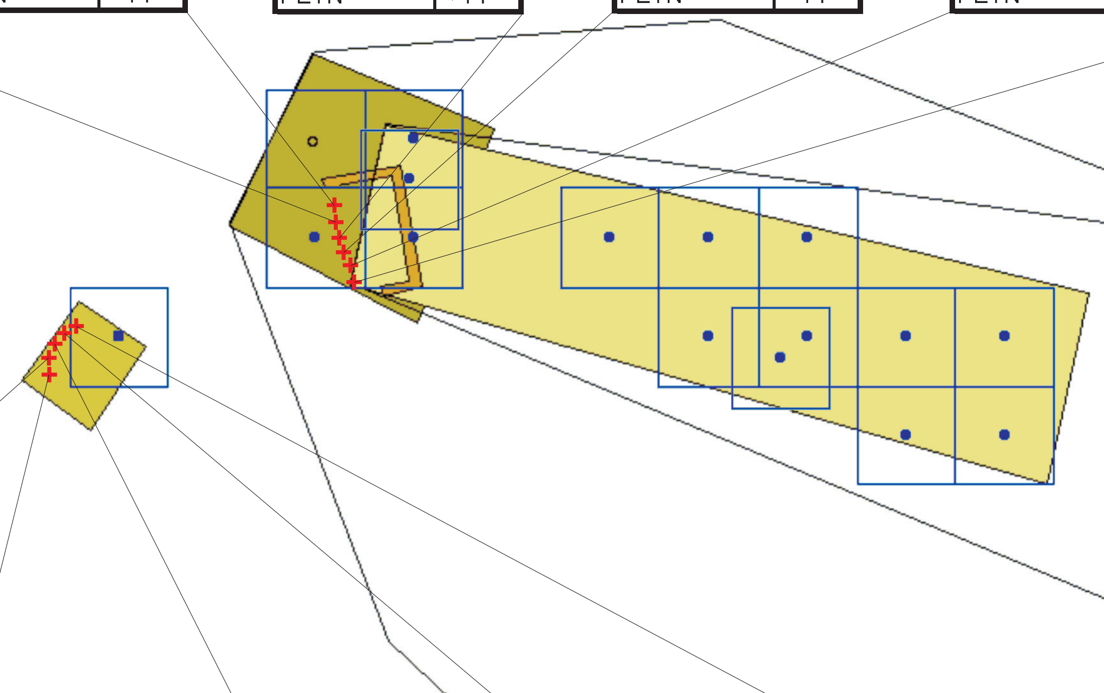
S62030317C	
HMX	< 2.7
RDX	< 2.7
1,3,5-TNB	< 2.7
1,3-DNB	< 2.7
Tetryl	< 2.7
NB	< 2.7
2,4,6-TNT	< 2.7
4-Am-DNT	< 2.7
2-Am-DNT	< 2.7
2,4-DNT	< 2.7
2,6-DNT	< 2.7
2-NT	< 2.7
3-NT	< 2.7
4-NT	< 2.7
Picric Acid	< 10
PETN	< 14

S62230317C	
HMX	< 2.7
RDX	< 2.7
1,3,5-TNB	< 2.7
1,3-DNB	< 2.7
Tetryl	< 2.7
NB	< 2.7
2,4,6-TNT	< 2.7
4-Am-DNT	< 2.7
2-Am-DNT	< 2.7
2,4-DNT	< 2.7
2,6-DNT	< 2.7
2-NT	< 2.7
3-NT	< 2.7
4-NT	< 2.7
Picric Acid	< 10
PETN	< 14

S62330317C	
HMX	< 2.7
RDX	< 2.7
1,3,5-TNB	< 2.7
1,3-DNB	< 2.7
Tetryl	< 2.7
NB	< 2.7
2,4,6-TNT	< 2.7
4-Am-DNT	< 2.7
2-Am-DNT	< 2.7
2,4-DNT	< 2.7
2,6-DNT	< 2.7
2-NT	< 2.7
3-NT	< 2.7
4-NT	< 2.7
Picric Acid	< 10
PETN	< 14

S62430317C	
HMX	< 2.6
RDX	< 2.6
1,3,5-TNB	< 2.6
1,3-DNB	< 2.6
Tetryl	< 2.6
NB	< 2.6
2,4,6-TNT	< 2.6
4-Am-DNT	< 2.6
2-Am-DNT	< 2.6
2,4-DNT	< 2.6
2,6-DNT	< 2.6
2-NT	< 2.6
3-NT	< 2.6
4-NT	< 2.6
Picric Acid	< 10
PETN	< 13

S62530317C	
HMX	< 2.7
RDX	< 2.7
1,3,5-TNB	< 2.7
1,3-DNB	< 2.7
Tetryl	< 2.7
NB	< 2.7
2,4,6-TNT	< 2.7
4-Am-DNT	< 2.7
2-Am-DNT	< 2.7
2,4-DNT	< 2.7
2,6-DNT	< 2.7
2-NT	< 2.7
3-NT	< 2.7
4-NT	< 2.7
Picric Acid	< 10
PETN	< 14



S66830301C	
HMX	< 3.0
RDX	< 3.0
1,3,5-TNB	< 3.0
1,3-DNB	< 3.0
Tetryl	< 3.0
NB	< 3.0
2,4,6-TNT	< 3.0
4-Am-DNT	< 3.0
2-Am-DNT	< 3.0
2,4-DNT	< 3.0
2,6-DNT	< 3.0
2-NT	< 3.0
3-NT	< 3.0
4-NT	< 3.0
Picric Acid	< 10
PETN	< 15

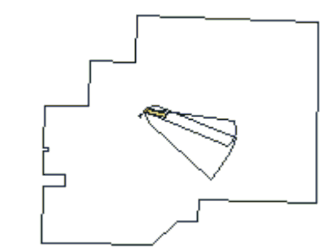
S66930301C	
HMX	< 2.8
RDX	< 2.8
1,3,5-TNB	< 2.8
1,3-DNB	< 2.8
Tetryl	< 2.8
NB	< 2.8
2,4,6-TNT	< 2.8
4-Am-DNT	< 2.8
2-Am-DNT	< 2.8
2,4-DNT	< 2.8
2,6-DNT	< 2.8
2-NT	< 2.8
3-NT	< 2.8
4-NT	< 2.8
Picric Acid	< 10
PETN	< 14

S66730301C	
HMX	< 2.7
RDX	< 2.7
1,3,5-TNB	< 2.7
1,3-DNB	< 2.7
Tetryl	< 2.7
NB	< 2.7
2,4,6-TNT	< 2.7
4-Am-DNT	< 2.7
2-Am-DNT	< 2.7
2,4-DNT	< 2.7
2,6-DNT	< 2.7
2-NT	< 2.7
3-NT	< 2.7
4-NT	< 2.7
Picric Acid	< 10
PETN	< 14

S66630301C	
HMX	< 3.0
RDX	< 3.0
1,3,5-TNB	< 3.0
1,3-DNB	< 3.0
Tetryl	< 3.0
NB	< 3.0
2,4,6-TNT	< 3.0
4-Am-DNT	< 3.0
2-Am-DNT	< 3.0
2,4-DNT	< 3.0
2,6-DNT	< 3.0
2-NT	< 3.0
3-NT	< 3.0
4-NT	< 3.0
Picric Acid	< 10
PETN	< 15

S66530301C	
HMX	< 3.1
RDX	< 3.1
1,3,5-TNB	< 3.1
1,3-DNB	< 3.1
Tetryl	< 3.1
NB	< 3.1
2,4,6-TNT	< 3.1
4-Am-DNT	< 3.1
2-Am-DNT	< 3.1
2,4-DNT	< 3.1
2,6-DNT	< 3.1
2-NT	< 3.1
3-NT	< 3.1
4-NT	< 3.1
Picric Acid	< 10
PETN	< 16

Key Map



Legend

Sampling Grid
Sampling Grid Center Points
Field Firing Range 2
Field Firing Range 2 & Pistol Range
Infiltration Course 1 & Pistol Range
Pistol Range
Undocumented Pistol Range
Muzzle Blast Zone Sample Points
Field Firing Ranges 1 & 2 and
Undocumented Pistol Range
Range Fan
Berms
Field Firing Ranges 1 and 2 and Pistol Range
Range Footprint
Field Firing Range
Pistol Range
Undocumented Pistol Range

200 0 200 400 600 Feet

N W E S

August 15, 2003

AEM
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Figure B-25

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

Combat Pistol Range
Muzzle Blast Zone Samples
(mg/Kg)

S62930313C

HMX	< 2.6
RDX	< 2.6
1,3,5-TNB	< 2.6
1,3-DNB	< 2.6
Tetryl	< 2.6
NB	< 2.6
2,4,6-TNT	< 2.6
4-Am-DNT	< 2.6
2-Am-DNT	< 2.6
2,4-DNT	< 2.6
2,6-DNT	< 2.6
2-NT	< 2.6
3-NT	< 2.6
4-NT	< 2.6
Picric Acid	< 10
PETN	< 13

S62730313C

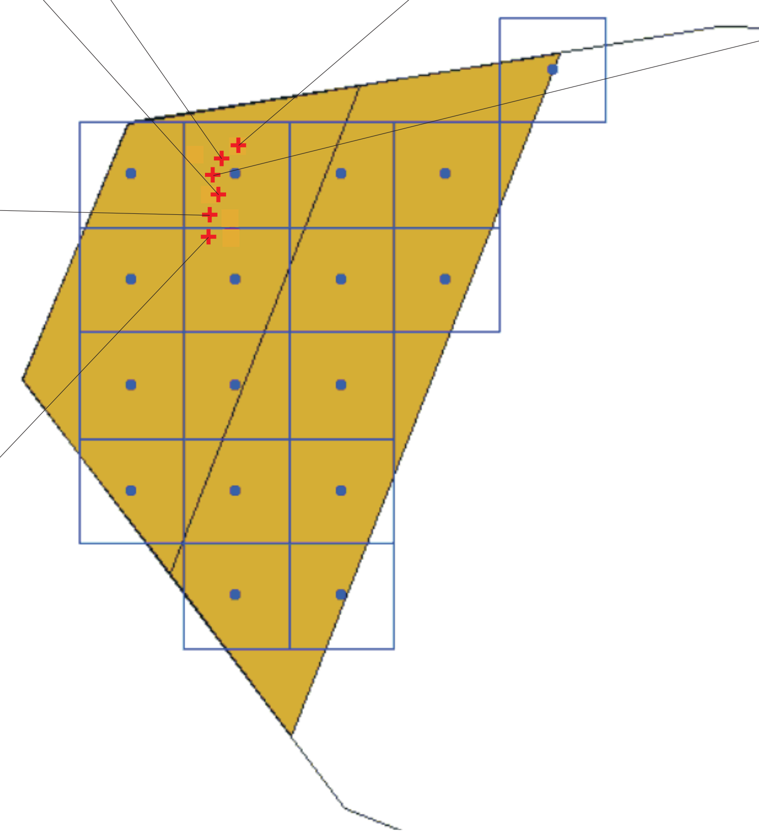
HMX	< 2.8
RDX	< 2.8
1,3,5-TNB	< 2.8
1,3-DNB	< 2.8
Tetryl	< 2.8
NB	< 2.8
2,4,6-TNT	< 2.8
4-Am-DNT	< 2.8
2-Am-DNT	< 2.8
2,4-DNT	< 2.8
2,6-DNT	< 2.8
2-NT	< 2.8
3-NT	< 2.8
4-NT	< 2.8
Picric Acid	< 10
PETN	< 14

S62630313C

HMX	< 2.4
RDX	< 2.4
1,3,5-TNB	< 2.4
1,3-DNB	< 2.4
Tetryl	< 2.4
NB	< 2.4
2,4,6-TNT	< 2.4
4-Am-DNT	< 2.4
2-Am-DNT	< 2.4
2,4-DNT	< 2.4
2,6-DNT	< 2.4
2-NT	< 2.4
3-NT	< 2.4
4-NT	< 2.4
Picric Acid	< 10
PETN	< 12

S62830313C

HMX	< 2.6
RDX	< 2.6
1,3,5-TNB	< 2.6
1,3-DNB	< 2.6
Tetryl	< 2.6
NB	< 2.6
2,4,6-TNT	< 2.6
4-Am-DNT	< 2.6
2-Am-DNT	< 2.6
2,4-DNT	< 2.6
2,6-DNT	< 2.6
2-NT	< 2.6
3-NT	< 2.6
4-NT	< 2.6
Picric Acid	< 10
PETN	< 13



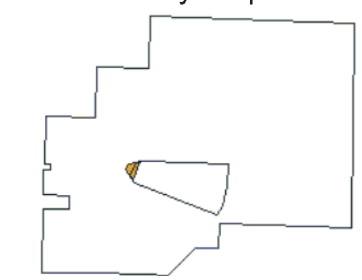
S63030313C

HMX	< 2.5
RDX	< 2.5
1,3,5-TNB	< 2.5
1,3-DNB	< 2.5
Tetryl	< 2.5
NB	< 2.5
2,4,6-TNT	< 2.5
4-Am-DNT	< 2.5
2-Am-DNT	< 2.5
2,4-DNT	< 2.5
2,6-DNT	< 2.5
2-NT	< 2.5
3-NT	< 2.5
4-NT	< 2.5
Picric Acid	< 10
PETN	< 13

S63130313C

HMX	< 2.8
RDX	< 2.8
1,3,5-TNB	< 2.8
1,3-DNB	< 2.8
Tetryl	< 2.8
NB	< 2.8
2,4,6-TNT	< 2.8
4-Am-DNT	< 2.8
2-Am-DNT	< 2.8
2,4-DNT	< 2.8
2,6-DNT	< 2.8
2-NT	< 2.8
3-NT	< 2.8
4-NT	< 2.8
Picric Acid	< 10
PETN	< 14

Key Map



Legend

- Sampling Grid
- Sampling Grid Center Points
  - Combat Pistol Range
  - Combat Pistol Range (drop zone)
- Muzzle Blast Zone Sample Points
  - Combat Pistol
- Range Fan
- Range Footprint
  - Combat Pistol Range

N
W E
S

200 0 200 400 Feet

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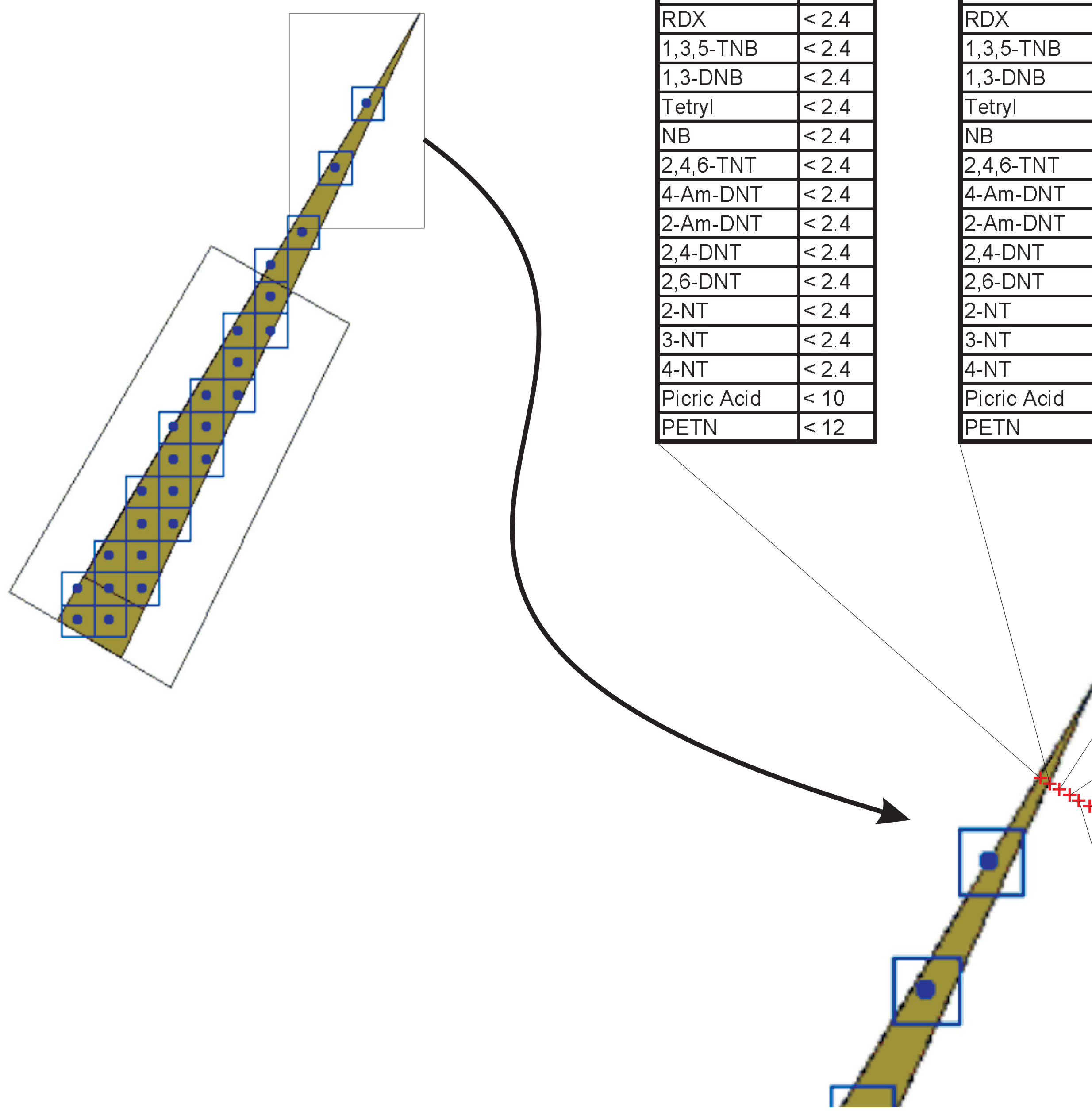


S63330318C

HMX	< 2.4
RDX	< 2.4
1,3,5-TNB	< 2.4
1,3-DNB	< 2.4
Tetryl	< 2.4
NB	< 2.4
2,4,6-TNT	< 2.4
4-Am-DNT	< 2.4
2-Am-DNT	< 2.4
2,4-DNT	< 2.4
2,6-DNT	< 2.4
2-NT	< 2.4
3-NT	< 2.4
4-NT	< 2.4
Picric Acid	< 10
PETN	< 12

S63430318C

HMX	< 2.3
RDX	< 2.3
1,3,5-TNB	< 2.3
1,3-DNB	< 2.3
Tetryl	< 2.3
NB	< 2.3
2,4,6-TNT	< 2.3
4-Am-DNT	< 2.3
2-Am-DNT	< 2.3
2,4-DNT	< 2.3
2,6-DNT	< 2.3
2-NT	< 2.3
3-NT	< 2.3
4-NT	< 2.3
Picric Acid	< 10
PETN	< 12

S63530318C

HMX	< 2.5
RDX	< 2.5
1,3,5-TNB	< 2.5
1,3-DNB	< 2.5
Tetryl	< 2.5
NB	< 2.5
2,4,6-TNT	< 2.5
4-Am-DNT	< 2.5
2-Am-DNT	< 2.5
2,4-DNT	< 2.5
2,6-DNT	< 2.5
2-NT	< 2.5
3-NT	< 2.5
4-NT	< 2.5
Picric Acid	< 10
PETN	< 13

S63630318C

HMX	< 2.3
RDX	< 2.3
1,3,5-TNB	< 2.3
1,3-DNB	< 2.3
Tetryl	< 2.3
NB	< 2.3
2,4,6-TNT	< 2.3
4-Am-DNT	< 2.3
2-Am-DNT	< 2.3
2,4-DNT	< 2.3
2,6-DNT	< 2.3
2-NT	< 2.3
3-NT	< 2.3
4-NT	< 2.3
Picric Acid	< 10
PETN	< 12

S63730318C

HMX	< 2.4
RDX	< 2.4
1,3,5-TNB	< 2.4
1,3-DNB	< 2.4
Tetryl	< 2.4
NB	< 2.4
2,4,6-TNT	< 2.4
4-Am-DNT	< 2.4
2-Am-DNT	< 2.4
2,4-DNT	< 2.4
2,6-DNT	< 2.4
2-NT	< 2.4
3-NT	< 2.4
4-NT	< 2.4
Picric Acid	< 10
PETN	< 12

S63830318C

HMX	< 2.3
RDX	< 2.3
1,3,5-TNB	< 2.3
1,3-DNB	< 2.3
Tetryl	< 2.3
NB	< 2.3
2,4,6-TNT	< 2.3
4-Am-DNT	< 2.3
2-Am-DNT	< 2.3
2,4-DNT	< 2.3
2,6-DNT	< 2.3
2-NT	< 2.3
3-NT	< 2.3
4-NT	< 2.3
Picric Acid	< 10
PETN	< 12

Figure B-26

Camp Bonneville

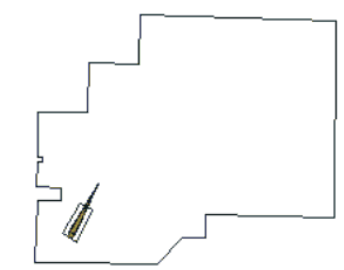
Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

M31 Sub-Caliber Ranges 1&2 Muzzle Blast Zone Samples (mg/Kg)

Key Map



Legend

Sampling Grid

Sampling Grid Center Points

Sub-caliber Artillery 1

Muzzle Blast Zone Sample Points

M31 Sub-Caliber Range

Range Fan

Range Footprint

Sub-caliber Artillery

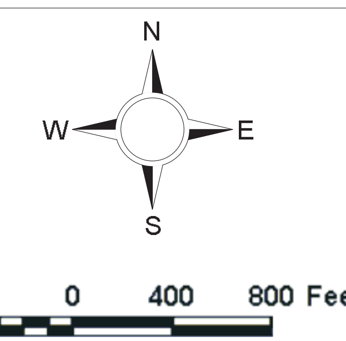


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Figure B-27

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002
Contract Number: GS-10F-0135M

25 Meter and Machine Gun Range Muzzle Blast Zone Samples (mg/Kg)

S64130306C

HMX	< 3.3
RDX	< 3.3
1,3,5-TNB	< 3.3
1,3-DNB	< 3.3
Tetryl	< 3.3
NB	< 3.3
2,4,6-TNT	< 3.3
4-Am-DNT	< 3.3
2-Am-DNT	< 3.3
2,4-DNT	12
2,6-DNT	< 3.3
2-NT	< 3.3
3-NT	< 3.3
4-NT	< 3.3
Picric Acid	< 10
PETN	< 17

S64030306C

HMX	< 2.7
RDX	< 2.7
1,3,5-TNB	< 2.7
1,3-DNB	< 2.7
Tetryl	< 2.7
NB	< 2.7
2,4,6-TNT	< 2.7
4-Am-DNT	< 2.7
2-Am-DNT	< 2.7
2,4-DNT	< 2.7
2,6-DNT	< 2.7
2-NT	< 2.7
3-NT	< 2.7
4-NT	< 2.7
Picric Acid	< 10
PETN	< 14

S63930306C

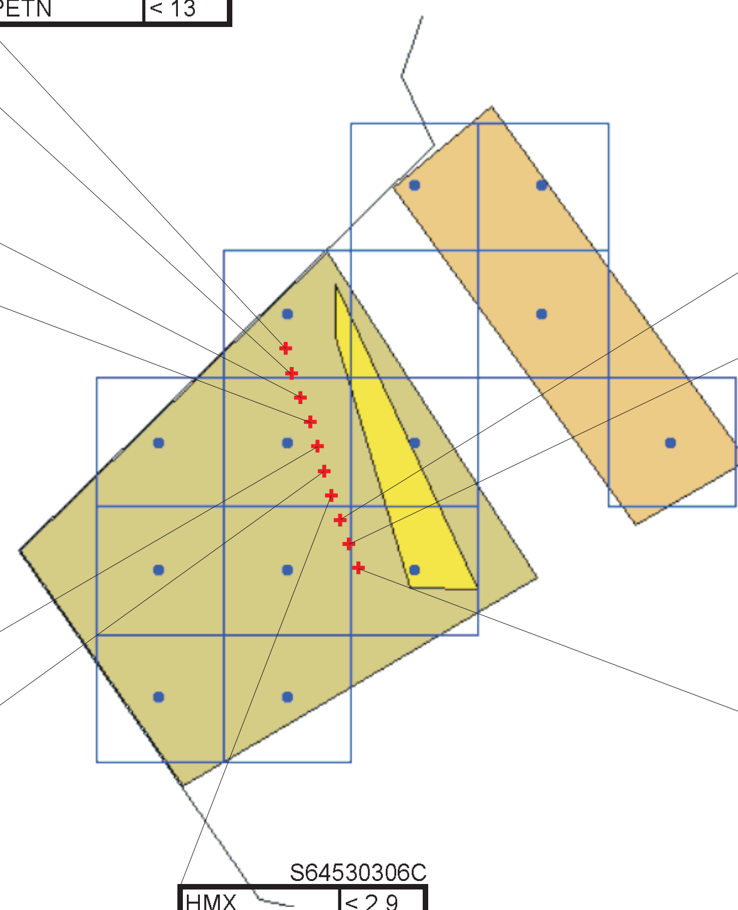
HMX	< 2.5
RDX	< 2.5
1,3,5-TNB	< 2.5
1,3-DNB	< 2.5
Tetryl	< 2.5
NB	< 2.5
2,4,6-TNT	< 2.5
4-Am-DNT	< 2.5
2-Am-DNT	< 2.5
2,4-DNT	< 2.5
2,6-DNT	< 2.5
2-NT	< 2.5
3-NT	< 2.5
4-NT	< 2.5
Picric Acid	< 10
PETN	< 13

S64630306C

HMX	< 2.9
RDX	< 2.9
1,3,5-TNB	< 2.9
1,3-DNB	< 2.9
Tetryl	< 2.9
NB	< 2.9
2,4,6-TNT	< 2.9
4-Am-DNT	< 2.9
2-Am-DNT	< 2.9
2,4-DNT	14
2,6-DNT	< 2.9
2-NT	< 2.9
3-NT	< 2.9
4-NT	< 2.9
Picric Acid	< 10
PETN	< 15

S64230306C

HMX	< 3.0
RDX	< 3.0
1,3,5-TNB	< 3.0
1,3-DNB	< 3.0
Tetryl	< 3.0
NB	< 3.0
2,4,6-TNT	< 3.0
4-Am-DNT	< 3.0
2-Am-DNT	< 3.0
2,4-DNT	12
2,6-DNT	< 3.0
2-NT	< 3.0
3-NT	< 3.0
4-NT	< 3.0
Picric Acid	< 10
PETN	< 15



S64730306C

HMX	< 2.9
RDX	< 2.9
1,3,5-TNB	< 2.9
1,3-DNB	< 2.9
Tetryl	< 2.9
NB	< 2.9
2,4,6-TNT	< 2.9
4-Am-DNT	< 2.9
2-Am-DNT	< 2.9
2,4-DNT	10
2,6-DNT	< 2.9
2-NT	< 2.9
3-NT	< 2.9
4-NT	< 2.9
Picric Acid	< 10
PETN	< 15

S64330306C

HMX	< 2.9
RDX	< 2.9
1,3,5-TNB	< 2.9
1,3-DNB	< 2.9
Tetryl	< 2.9
NB	< 2.9
2,4,6-TNT	< 2.9
4-Am-DNT	< 2.9
2-Am-DNT	< 2.9
2,4-DNT	17
2,6-DNT	< 2.9
2-NT	< 2.9
3-NT	< 2.9
4-NT	< 2.9
Picric Acid	< 10
PETN	< 15

S64430306C

HMX	< 2.4
RDX	< 2.4
1,3,5-TNB	< 2.4
1,3-DNB	< 2.4
Tetryl	< 2.4
NB	< 2.4
2,4,6-TNT	< 2.4
4-Am-DNT	< 2.4
2-Am-DNT	< 2.4
2,4-DNT	5.4
2,6-DNT	< 2.4
2-NT	< 2.4
3-NT	< 2.4
4-NT	< 2.4
Picric Acid	< 10
PETN	< 12

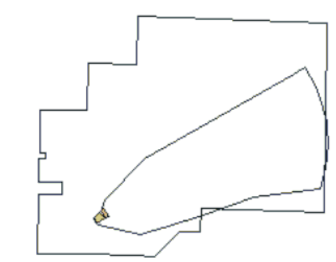
S64530306C

HMX	< 2.9
RDX	< 2.9
1,3,5-TNB	< 2.9
1,3-DNB	< 2.9
Tetryl	< 2.9
NB	< 2.9
2,4,6-TNT	< 2.9
4-Am-DNT	< 2.9
2-Am-DNT	< 2.9
2,4-DNT	20
2,6-DNT	< 2.9
2-NT	< 2.9
3-NT	< 2.9
4-NT	< 2.9
Picric Acid	< 10
PETN	< 15

S64830306C

HMX	< 2.8
RDX	< 2.8
1,3,5-TNB	< 2.8
1,3-DNB	< 2.8
Tetryl	< 2.8
NB	< 2.8
2,4,6-TNT	< 2.8
4-Am-DNT	< 2.8
2-Am-DNT	< 2.8
2,4-DNT	4.9
2,6-DNT	< 2.8
2-NT	< 2.8
3-NT	< 2.8
4-NT	< 2.8
Picric Acid	< 10
PETN	< 14

Key Map



Legend

Sampling Grid
Sampling Grid Center Points
25M Range, Machine Gun Range
25M Range, Machine Gun Range (drop zone)
Muzzle Blast Zone Sample Points
25M and Machine Gun Range
Berm
Range Fan
Range Footprint
25M Range, Machine Gun Range
25M Range, Machine Gun Range (drop zone)

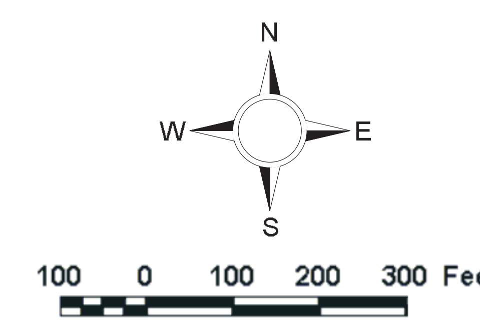


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Figure B-28

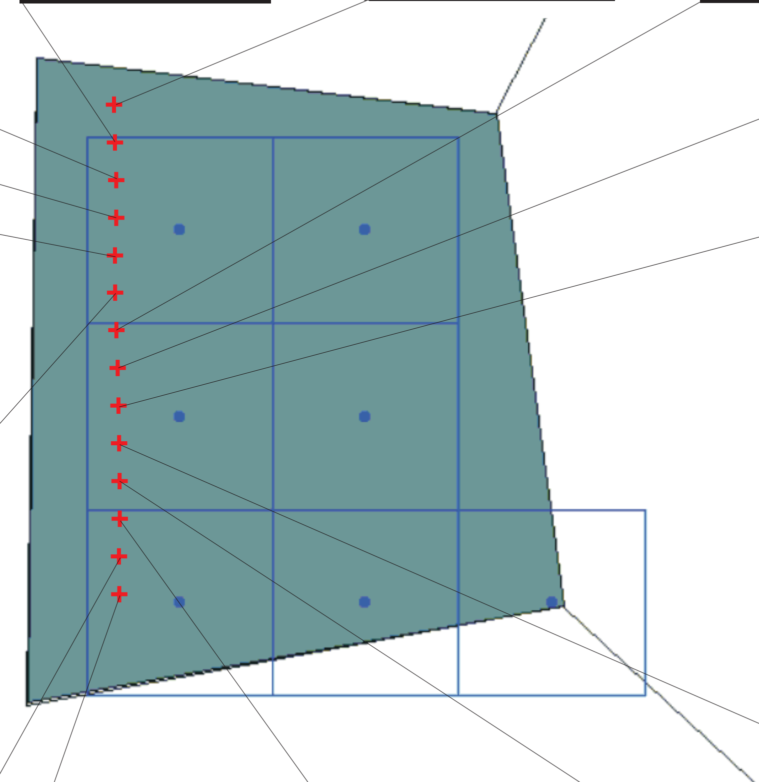
Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Infiltration Course South Muzzle Blast Zone Samples (mg/Kg)



S65230306C	
HMX	< 3.0
RDX	< 3.0
1,3,5-TNB	< 3.0
1,3-DNB	< 3.0
Tetryl	< 3.0
NB	< 3.0
2,4,6-TNT	< 3.0
4-Am-DNT	< 3.0
2-Am-DNT	< 3.0
2,4-DNT	< 3.0
2,6-DNT	< 3.0
2-NT	< 3.0
3-NT	< 3.0
4-NT	< 3.0
Picric Acid	< 10
PETN	< 15

S65130306C	
HMX	< 2.8
RDX	< 2.8
1,3,5-TNB	< 2.8
1,3-DNB	< 2.8
Tetryl	< 2.8
NB	< 2.8
2,4,6-TNT	< 2.8
4-Am-DNT	< 2.8
2-Am-DNT	< 2.8
2,4-DNT	< 2.8
2,6-DNT	< 2.8
2-NT	< 2.8
3-NT	< 2.8
4-NT	< 2.8
Picric Acid	< 10
PETN	< 14

S65030306C	
HMX	< 2.7
RDX	< 2.7
1,3,5-TNB	< 2.7
1,3-DNB	< 2.7
Tetryl	< 2.7
NB	< 2.7
2,4,6-TNT	< 2.7
4-Am-DNT	< 2.7
2-Am-DNT	< 2.7
2,4-DNT	< 2.7
2,6-DNT	< 2.7
2-NT	< 2.7
3-NT	< 2.7
4-NT	< 2.7
Picric Acid	< 10
PETN	< 14

S64930306C	
HMX	< 2.9
RDX	< 2.9
1,3,5-TNB	< 2.9
1,3-DNB	< 2.9
Tetryl	< 2.9
NB	< 2.9
2,4,6-TNT	< 2.9
4-Am-DNT	< 2.9
2-Am-DNT	< 2.9
2,4-DNT	< 2.9
2,6-DNT	< 2.9
2-NT	< 2.9
3-NT	< 2.9
4-NT	< 2.9
Picric Acid	< 10
PETN	< 15

S65530306C	
HMX	< 3.0
RDX	< 3.0
1,3,5-TNB	< 3.0
1,3-DNB	< 3.0
Tetryl	< 3.0
NB	< 3.0
2,4,6-TNT	< 3.0
4-Am-DNT	< 3.0
2-Am-DNT	< 3.0
2,4-DNT	< 3.0
2,6-DNT	< 3.0
2-NT	< 3.0
3-NT	< 3.0
4-NT	< 3.0
Picric Acid	< 10
PETN	< 15

S65630306C	
HMX	< 3.0
RDX	< 3.0
1,3,5-TNB	< 3.0
1,3-DNB	< 3.0
Tetryl	< 3.0
NB	< 3.0
2,4,6-TNT	< 3.0
4-Am-DNT	< 3.0
2-Am-DNT	< 3.0
2,4-DNT	< 3.0
2,6-DNT	< 3.0
2-NT	< 3.0
3-NT	< 3.0
4-NT	< 3.0
Picric Acid	< 10
PETN	< 15

S65330306C	
HMX	< 2.9
RDX	< 2.9
1,3,5-TNB	< 2.9
1,3-DNB	< 2.9
Tetryl	< 2.9
NB	< 2.9
2,4,6-TNT	< 2.9
4-Am-DNT	< 2.9
2-Am-DNT	< 2.9
2,4-DNT	< 2.9
2,6-DNT	< 2.9
2-NT	< 2.9
3-NT	< 2.9
4-NT	< 2.9
Picric Acid	< 10
PETN	< 15

S65730306C	
HMX	< 3.2
RDX	< 3.2
1,3,5-TNB	< 3.2
1,3-DNB	< 3.2
Tetryl	< 3.2
NB	< 3.2
2,4,6-TNT	< 3.2
4-Am-DNT	< 3.2
2-Am-DNT	< 3.2
2,4-DNT	< 3.2
2,6-DNT	< 3.2
2-NT	< 3.2
3-NT	< 3.2
4-NT	< 3.2
Picric Acid	< 10
PETN	< 16

S65430306C	
HMX	< 3.0
RDX	< 3.0
1,3,5-TNB	< 3.0
1,3-DNB	< 3.0
Tetryl	< 3.0
NB	< 3.0
2,4,6-TNT	< 3.0
4-Am-DNT	< 3.0
2-Am-DNT	< 3.0
2,4-DNT	< 3.0
2,6-DNT	< 3.0
2-NT	< 3.0
3-NT	< 3.0
4-NT	< 3.0
Picric Acid	< 10
PETN	< 15

S66130306C	
HMX	< 2.6
RDX	< 2.6
1,3,5-TNB	< 2.6
1,3-DNB	< 2.6
Tetryl	< 2.6
NB	< 2.6
2,4,6-TNT	< 2.6
4-Am-DNT	< 2.6
2-Am-DNT	< 2.6
2,4-DNT	< 2.6
2,6-DNT	< 2.6
2-NT	< 2.6
3-NT	< 2.6
4-NT	< 2.6
Picric Acid	< 10
PETN	< 13

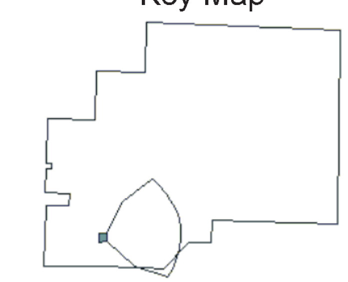
S66230306C	
HMX	< 2.7
RDX	< 2.7
1,3,5-TNB	< 2.7
1,3-DNB	< 2.7
Tetryl	< 2.7
NB	< 2.7
2,4,6-TNT	< 2.7
4-Am-DNT	< 2.7
2-Am-DNT	< 2.7
2,4-DNT	< 2.7
2,6-DNT	< 2.7
2-NT	< 2.7
3-NT	< 2.7
4-NT	< 2.7
Picric Acid	< 10
PETN	< 14

S66030306C	
HMX	< 2.3
RDX	< 2.3
1,3,5-TNB	< 2.3
1,3-DNB	< 2.3
Tetryl	< 2.3
NB	< 2.3
2,4,6-TNT	< 2.3
4-Am-DNT	< 2.3
2-Am-DNT	< 2.3
2,4-DNT	< 2.3
2,6-DNT	< 2.3
2-NT	< 2.3
3-NT	< 2.3
4-NT	< 2.3
Picric Acid	< 10
PETN	< 12

S65930306C	
HMX	< 2.5
RDX	< 2.5
1,3,5-TNB	< 2.5
1,3-DNB	< 2.5
Tetryl	< 2.5
NB	< 2.5
2,4,6-TNT	< 2.5
4-Am-DNT	< 2.5
2-Am-DNT	< 2.5
2,4-DNT	< 2.5
2,6-DNT	< 2.5
2-NT	< 2.5
3-NT	< 2.5
4-NT	< 2.5
Picric Acid	< 10
PETN	< 13

S65830306C	
HMX	< 2.8
RDX	< 2.8
1,3,5-TNB	< 2.8
1,3-DNB	< 2.8
Tetryl	< 2.8
NB	< 2.8
2,4,6-TNT	< 2.8
4-Am-DNT	< 2.8
2-Am-DNT	< 2.8
2,4-DNT	< 2.8
2,6-DNT	< 2.8
2-NT	< 2.8
3-NT	< 2.8
4-NT	< 2.8
Picric Acid	< 10
PETN	< 14

Key Map



Legend

Sampling Grid

Sampling Grid Center Points

Infiltration Course 2

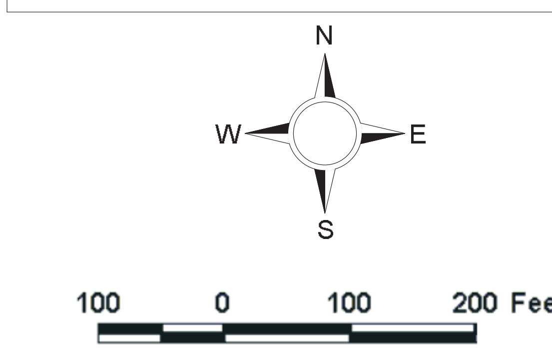
Muzzle Blast Zone Sample Points

Infiltration Course South

Range Fan

Range Footprint

Infiltration Course 2



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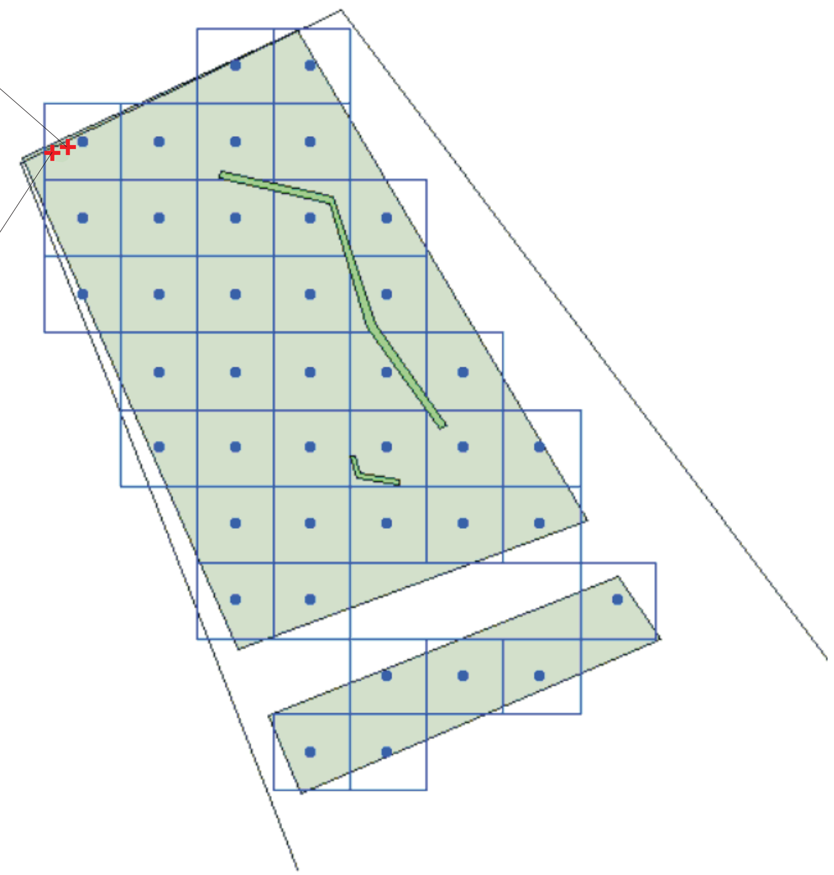
S66430314C	
HMX	< 2.7
RDX	< 2.7
1,3,5-TNB	< 2.7
1,3-DNB	< 2.7
Tetryl	< 2.7
NB	< 2.7
2,4,6-TNT	< 2.7
4-Am-DNT	< 2.7
2-Am-DNT	< 2.7
2,4-DNT	< 2.7
2,6-DNT	< 2.7
2-NT	< 2.7
3-NT	< 2.7
4-NT	< 2.7
Picric Acid	< 10
PETN	< 14



S66330314C	
HMX	< 2.9
RDX	< 2.9
1,3,5-TNB	< 2.9
1,3-DNB	< 2.9
Tetryl	< 2.9
NB	< 2.9
2,4,6-TNT	< 2.9
4-Am-DNT	< 2.9
2-Am-DNT	< 2.9
2,4-DNT	< 2.9
2,6-DNT	< 2.9
2-NT	< 2.9
3-NT	< 2.9
4-NT	< 2.9
Picric Acid	< 10
PETN	< 15

Figure B-29

Camp Bonneville

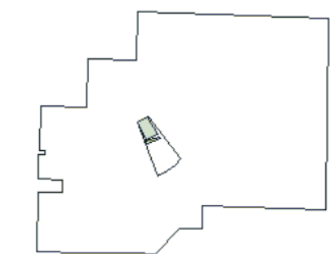
Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

25M Record Fire Field Range
Field Firing Range
Muzzle Blast Zone Samples
(mg/Kg)

Key Map



Legend

- Berms.shp
- Firing_line_sample_points.shp
  - 25M Record Fire Field Range, F
  - Grid_centerpoint_dz.shp
- Centerpoint_polygons.shp
- Ranges_smallarms.shp
- Footprints.shp
  - 25M Range, Record Firing Range, Field Firing Range

N
W E
S

200 0 200 400 600 Feet

August 15, 2003

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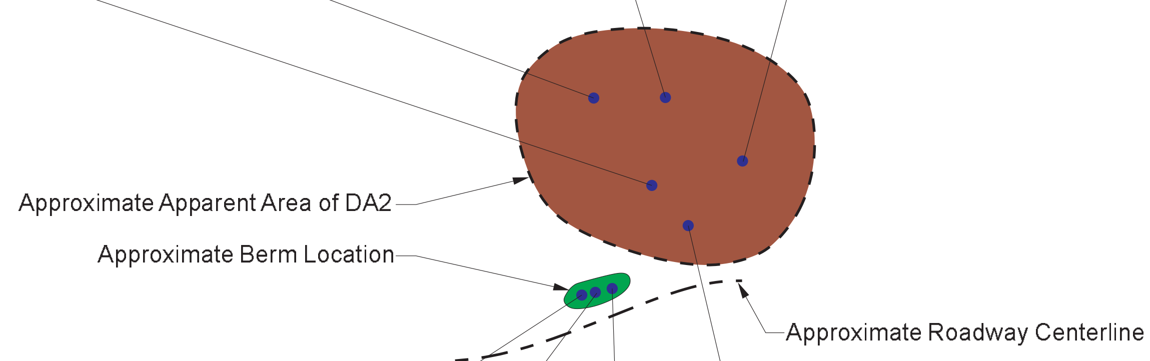
	S71330227C Sur	S71430227C 2.5 ft.
HMX	< 2.9	< 2.5
RDX	< 2.9	< 2.5
1,3,5-TNB	< 2.9	< 2.5
1,3-DNB	< 2.9	< 2.5
Tetryl	< 2.9	< 2.5
NB	< 2.9	< 2.5
2,4,6-TNT	< 2.9	< 2.5
4-Am-DNT	< 2.9	< 2.5
2-Am-DNT	< 2.9	< 2.5
2,4-DNT	< 2.9	< 2.5
2,6-DNT	< 2.9	< 2.5
2-NT	< 2.9	< 2.5
3-NT	< 2.9	< 2.5
4-NT	< 2.9	< 2.5
Picric Acid	< 10	< 10
PETN	< 15	< 13
Perchlorate	< .033	< .033

	S70430227C Sur	S70530227C 2.5 ft.
HMX	< 2.7	< 2.8
RDX	< 2.7	< 2.8
1,3,5-TNB	< 2.7	< 2.8
1,3-DNB	< 2.7	< 2.8
Tetryl	< 2.7	< 2.8
NB	< 2.7	< 2.8
2,4,6-TNT	< 2.7	< 2.8
4-Am-DNT	< 2.7	< 2.8
2-Am-DNT	< 2.7	< 2.8
2,4-DNT	< 2.7	< 2.8
2,6-DNT	< 2.7	< 2.8
2-NT	< 2.7	< 2.8
3-NT	< 2.7	< 2.8
4-NT	< 2.7	< 2.8
Picric Acid	< 10	< 10
PETN	< 14	< 14
Perchlorate	< .033	< .033

	S71030227C Sur	S71130227C 2.5 ft.	S71230227C 4 ft.
HMX	< 3.1	< 2.7	< 3.2
RDX	< 3.1	< 2.7	< 3.2
1,3,5-TNB	< 3.1	< 2.7	< 3.2
1,3-DNB	< 3.1	< 2.7	< 3.2
Tetryl	< 3.1	< 2.7	< 3.2
NB	< 3.1	< 2.7	< 3.2
2,4,6-TNT	< 3.1	< 2.7	< 3.2
4-Am-DNT	< 3.1	< 2.7	< 3.2
2-Am-DNT	< 3.1	< 2.7	< 3.2
2,4-DNT	< 3.1	< 2.7	< 3.2
2,6-DNT	< 3.1	< 2.7	< 3.2
2-NT	< 3.1	< 2.7	< 3.2
3-NT	< 3.1	< 2.7	< 3.2
4-NT	< 3.1	< 2.7	< 3.2
Picric Acid	< 10	< 10	< 10
PETN	< 16	< 14	< 16
Perchlorate	< .033	< .033	< .033

	S70130227C Sur	S70230227C 2.5 ft.
HMX	< 2.8	< 2.6
RDX	< 2.8	< 2.6
1,3,5-TNB	< 2.8	< 2.6
1,3-DNB	< 2.8	< 2.6
Tetryl	< 2.8	< 2.6
NB	< 2.8	< 2.6
2,4,6-TNT	< 2.8	< 2.6
4-Am-DNT	< 2.8	< 2.6
2-Am-DNT	< 2.8	< 2.6
2,4-DNT	< 2.8	< 2.6
2,6-DNT	< 2.8	< 2.6
2-NT	< 2.8	< 2.6
3-NT	< 2.8	< 2.6
4-NT	< 2.8	< 2.6
Picric Acid	< 10	< 10
PETN	< 14	< 13
Perchlorate	< .033	< .033



	S71630227C 2 ft.	S71730227C 2 ft.	S71830227C 2 ft.
HMX	< 2.8	< 2.7	< 2.5
RDX	< 2.8	< 2.7	< 2.5
1,3,5-TNB	< 2.8	< 2.7	< 2.5
1,3-DNB	< 2.8	< 2.7	< 2.5
Tetryl	< 2.8	< 2.7	< 2.5
NB	< 2.8	< 2.7	< 2.5
2,4,6-TNT	< 2.8	< 2.7	< 2.5
4-Am-DNT	< 2.8	< 2.7	< 2.5
2-Am-DNT	< 2.8	< 2.7	< 2.5
2,4-DNT	< 2.8	< 2.7	< 2.5
2,6-DNT	< 2.8	< 2.7	< 2.5
2-NT	< 2.8	< 2.7	< 2.5
3-NT	< 2.8	< 2.7	< 2.5
4-NT	< 2.8	< 2.7	< 2.5
Picric Acid	< 10	< 10	< 10
PETN	< 14	< 14	< 13
Perchlorate	< .033	< .033	< .033

	S70730227C Sur	S70830227C 2.5 ft.	S70930227C 5 ft.
HMX	< 2.5	< 2.7	< 3.0
RDX	< 2.5	< 2.7	< 3.0
1,3,5-TNB	< 2.5	< 2.7	< 3.0
1,3-DNB	< 2.5	< 2.7	< 3.0
Tetryl	< 2.5	< 2.7	< 3.0
NB	< 2.5	< 2.7	< 3.0
2,4,6-TNT	< 2.5	< 2.7	< 3.0
4-Am-DNT	< 2.5	< 2.7	< 3.0
2-Am-DNT	< 2.5	< 2.7	< 3.0
2,4-DNT	< 2.5	< 2.7	< 3.0
2,6-DNT	< 2.5	< 2.7	< 3.0
2-NT	< 2.5	< 2.7	< 3.0
3-NT	< 2.5	< 2.7	< 3.0
4-NT	< 2.5	< 2.7	< 3.0
Picric Acid	< 10	< 10	< 10
PETN	< 13	< 14	< 15
Perchlorate	< .033	< .033	< .033

Figure B-30

Camp Bonneville

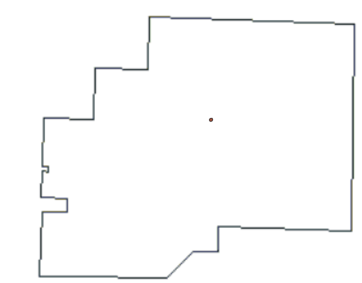
Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

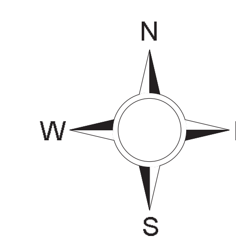
Demolition Area 2 Explosive Residuals and Perchlorate (mg/Kg)

Key Map



Legend

- **Sampling Grid Center Point**
- **Berm Footprint**
- **Demolition Area D2**
- **Sur** **Surface Sample**



Approximate Scale

200 0 100 200 400

1 inch = 200 ft.

August 15, 2003

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Figure B-30a

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

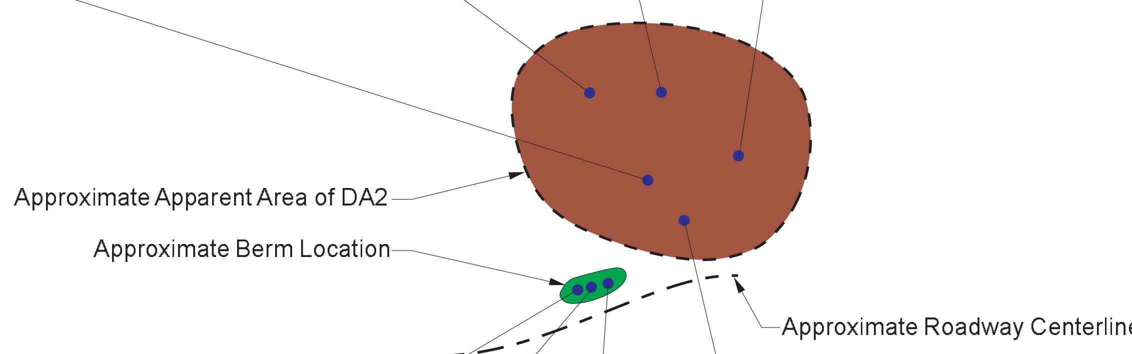
Demolition Area 2 Priority Pollutant Metal Results by Method 6010 (mg/Kg)

	S71330227C Sur	S71430227C 2.5 ft.
SB	< 10.5	< 11.1
AS	30.1	29.7
BA	181	130
CD	< 1.1	< 1.1
CR	30.1	31.2
CU	77.4	63.8
PB	< 21	< 22.1
NI	21.6	15
ZN	69.4	50

	S70430227C Sur	S70530227C 2.5 ft.
SB	< 10.7	< 11.9
AS	< 21.3	< 23.7
BA	208	215
CD	< 1.1	< 1.2
CR	25.3	36.7
CU	70.7	127
PB	< 21.3	< 23.7
NI	17.6	23.9
ZN	66.8	75.5

	S71030227C Sur	S71130227C 2.5 ft.	S71230227C 4 ft.
SB	< 11.7	< 11.4	< 11.6
AS	< 23.4	29.4	23.6
BA	228	262	454
CD	< 1.2	< 1.1	< 1.2
CR	36.8	39	34.9
CU	117	120	160
PB	< 23.4	< 22.9	< 23.1
NI	27.2	27.8	28.5
ZN	84.7	66.2	81.2

	S70130227C Sur	S70230227C 2.5 ft.
SB	< 10.9	< 10.9
AS	< 21.8	< 21.8
BA	152	121
CD	< 1.1	< 1.1
CR	43	42.3
CU	87.7	82.4
PB	< 21.8	< 21.8
NI	17.8	16.6
ZN	101	52.6



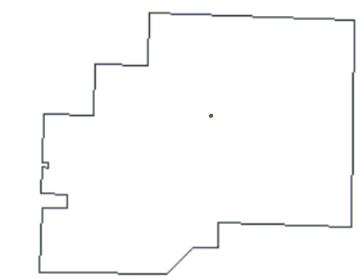
	S71630227C 2 ft.
SB	< 10.4
AS	< 20.7
BA	264
CD	< 1
CR	30.3
CU	92.6
PB	36.5
NI	16.8
ZN	74.6

	S71730227C 2 ft.
SB	< 11.6
AS	< 23.3
BA	246
CD	< 1.2
CR	34.2
CU	94.9
PB	< 23.3
NI	22.3
ZN	68.1

	S71830227C 2 ft.
SB	< 11.8
AS	29.3
BA	313
CD	< 1.2
CR	37.1
CU	104
PB	< 23.6
NI	24.9
ZN	75.5

	S70730227C Sur	S70830227C 2.5 ft.	S70930227C 5 ft.
SB	< 11.3	< 11.5	< 10.9
AS	< 22.6	< 23	28.5
BA	166	180	123
CD	< 1.1	< 1.2	< 1.1
CR	33.3	33.6	43.6
CU	96.2	90.6	105
PB	< 22.6	< 23	< 21.8
NI	16.4	16.6	28.2
ZN	61.1	76.2	73.7

Key Map



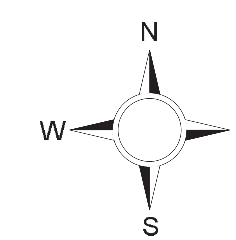
Legend

- Sampling Grid Center Point
- Berm

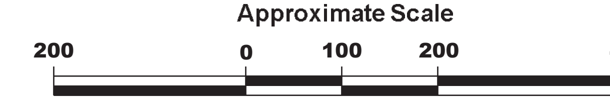
Footprint

- Demolition Area 2

Sur Surface Sample



Approximate Scale



1 inch = 200 ft.

August 15, 2003

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Figure B-31

Camp Bonneville

Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

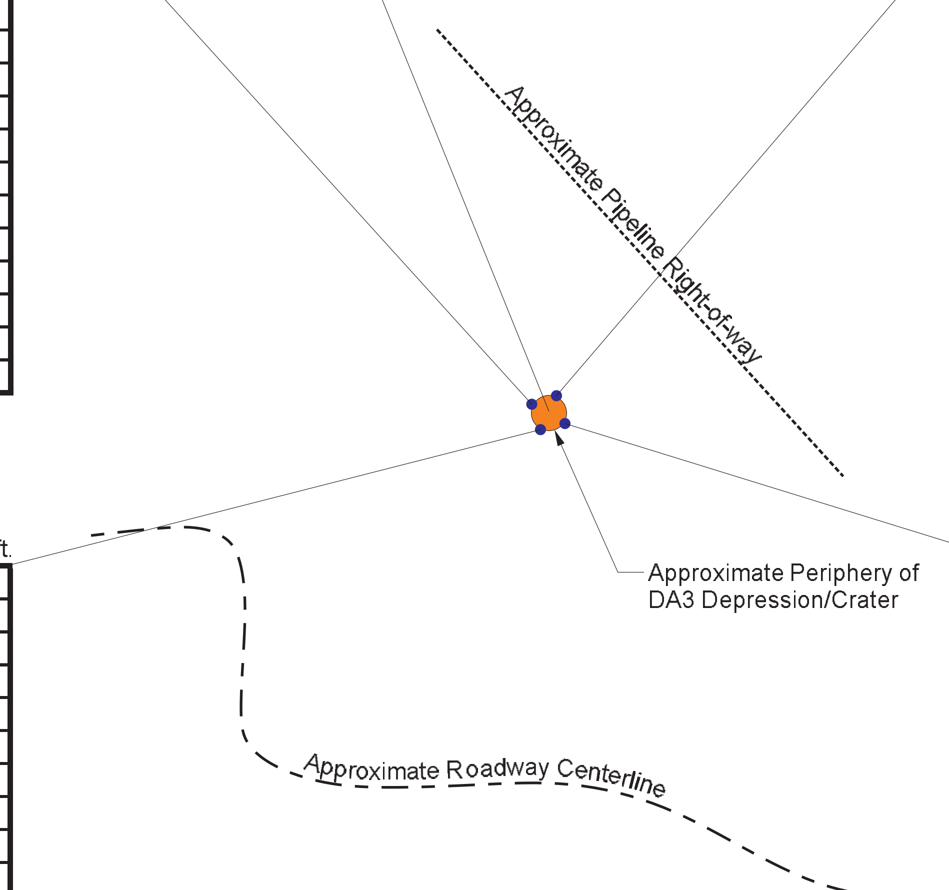
Contract Number: GS-10F-0135M

Demolition Area 3 Explosive Residuals and Perchlorate (mg/Kg)

WDA230321P	Water
HMX	< 3.0
RDX	< 3.0
1,3,5-TNB	< 3.0
1,3-DNB	< 3.0
Tetryl	< 3.0
NB	< 3.0
2,4,6-TNT	< 3.0
4-Am-DNT	< 3.0
2-Am-DNT	< 3.0
2,4-DNT	< 3.0
2,6-DNT	< 3.0
2-NT	< 3.0
3-NT	< 3.0
4-NT	< 3.0
Picric Acid	< 3.0
PETN	< 3.0
Perchlorate	< 3.0

S80330227C	Sur	S80430227C	2.5 ft.
HMX	< 2.8	HMX	< 2.5
RDX	< 2.8	RDX	< 2.5
1,3,5-TNB	< 2.8	1,3,5-TNB	< 2.5
1,3-DNB	< 2.8	1,3-DNB	< 2.5
Tetryl	< 2.8	Tetryl	< 2.5
NB	< 2.8	NB	< 2.5
2,4,6-TNT	< 2.8	2,4,6-TNT	< 2.5
4-Am-DNT	< 2.8	4-Am-DNT	< 2.5
2-Am-DNT	< 2.8	2-Am-DNT	< 2.5
2,4-DNT	< 2.8	2,4-DNT	< 2.5
2,6-DNT	< 2.8	2,6-DNT	< 2.5
2-NT	< 2.8	2-NT	< 2.5
3-NT	< 2.8	3-NT	< 2.5
4-NT	< 2.8	4-NT	< 2.5
Picric Acid	< 10	Picric Acid	< 10
PETN	< 14	PETN	< 13
Perchlorate	< .33	Perchlorate	< .033

S80930227C	Sur	S81030227C	2.5 ft.
HMX	< 2.7	HMX	< 2.5
RDX	< 2.7	RDX	< 2.5
1,3,5-TNB	< 2.7	1,3,5-TNB	< 2.5
1,3-DNB	< 2.7	1,3-DNB	< 2.5
Tetryl	< 2.7	Tetryl	< 2.5
NB	< 2.7	NB	< 2.5
2,4,6-TNT	< 2.7	2,4,6-TNT	< 2.5
4-Am-DNT	< 2.7	4-Am-DNT	< 2.5
2-Am-DNT	< 2.7	2-Am-DNT	< 2.5
2,4-DNT	< 2.7	2,4-DNT	< 2.5
2,6-DNT	< 2.7	2,6-DNT	< 2.5
2-NT	< 2.7	2-NT	< 2.5
3-NT	< 2.7	3-NT	< 2.5
4-NT	< 2.7	4-NT	< 2.5
Picric Acid	< 10	Picric Acid	< 10
PETN	< 14	PETN	< 13
Perchlorate	< .33	Perchlorate	< .33

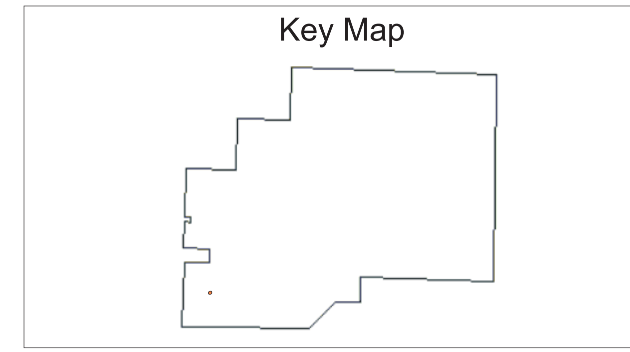


S80530227C	Sur	S80630227C	2.5 ft.
HMX	< 3.0	HMX	< 2.6
RDX	< 3.0	RDX	< 2.6
1,3,5-TNB	< 3.0	1,3,5-TNB	< 2.6
1,3-DNB	< 3.0	1,3-DNB	< 2.6
Tetryl	< 3.0	Tetryl	< 2.6
NB	< 3.0	NB	< 2.6
2,4,6-TNT	< 3.0	2,4,6-TNT	< 2.6
4-Am-DNT	< 3.0	4-Am-DNT	< 2.6
2-Am-DNT	< 3.0	2-Am-DNT	< 2.6
2,4-DNT	< 3.0	2,4-DNT	< 2.6
2,6-DNT	< 3.0	2,6-DNT	< 2.6
2-NT	< 3.0	2-NT	< 2.6
3-NT	< 3.0	3-NT	< 2.6
4-NT	< 3.0	4-NT	< 2.6
Picric Acid	< 10	Picric Acid	< 10
PETN	< 15	PETN	< 13
Perchlorate	< .033	Perchlorate	< .33

S80730227C	Sur
HMX	< 2.5
RDX	< 2.5
1,3,5-TNB	< 2.5
1,3-DNB	< 2.5
Tetryl	< 2.5
NB	< 2.5
2,4,6-TNT	< 2.5
4-Am-DNT	< 2.5
2-Am-DNT	< 2.5
2,4-DNT	< 2.5
2,6-DNT	< 2.5
2-NT	< 2.5
3-NT	< 2.5
4-NT	< 2.5
Picric Acid	< 10
PETN	< 13
Perchlorate	< .33

S80830227C	2.5 ft.
Picric Acid	< 10
PETN	< 13
Perchlorate	< .33
HMX	< 2.5
RDX	< 2.5
1,3,5-TNB	< 2.5
1,3-DNB	< 2.5
Tetryl	< 2.5
NB	< 2.5
2,4,6-TNT	< 2.5
4-Am-DNT	< 2.5
2-Am-DNT	< 2.5
2,4-DNT	< 2.5
2,6-DNT	< 2.5
2-NT	< 2.5
3-NT	< 2.5

Key Map

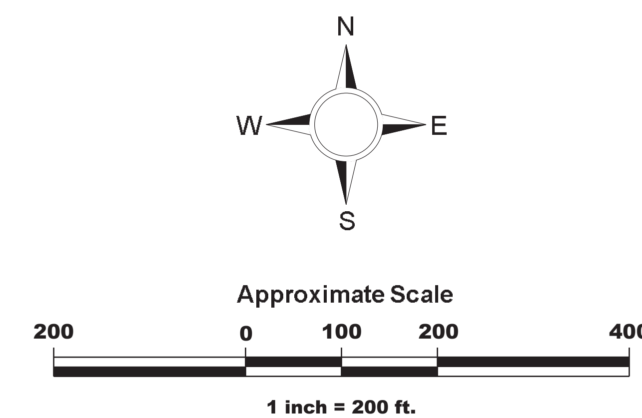


Legend

- Sampling Grid Center Point

Footprint

- Demolition Area D3
- Sur: Surface Sample



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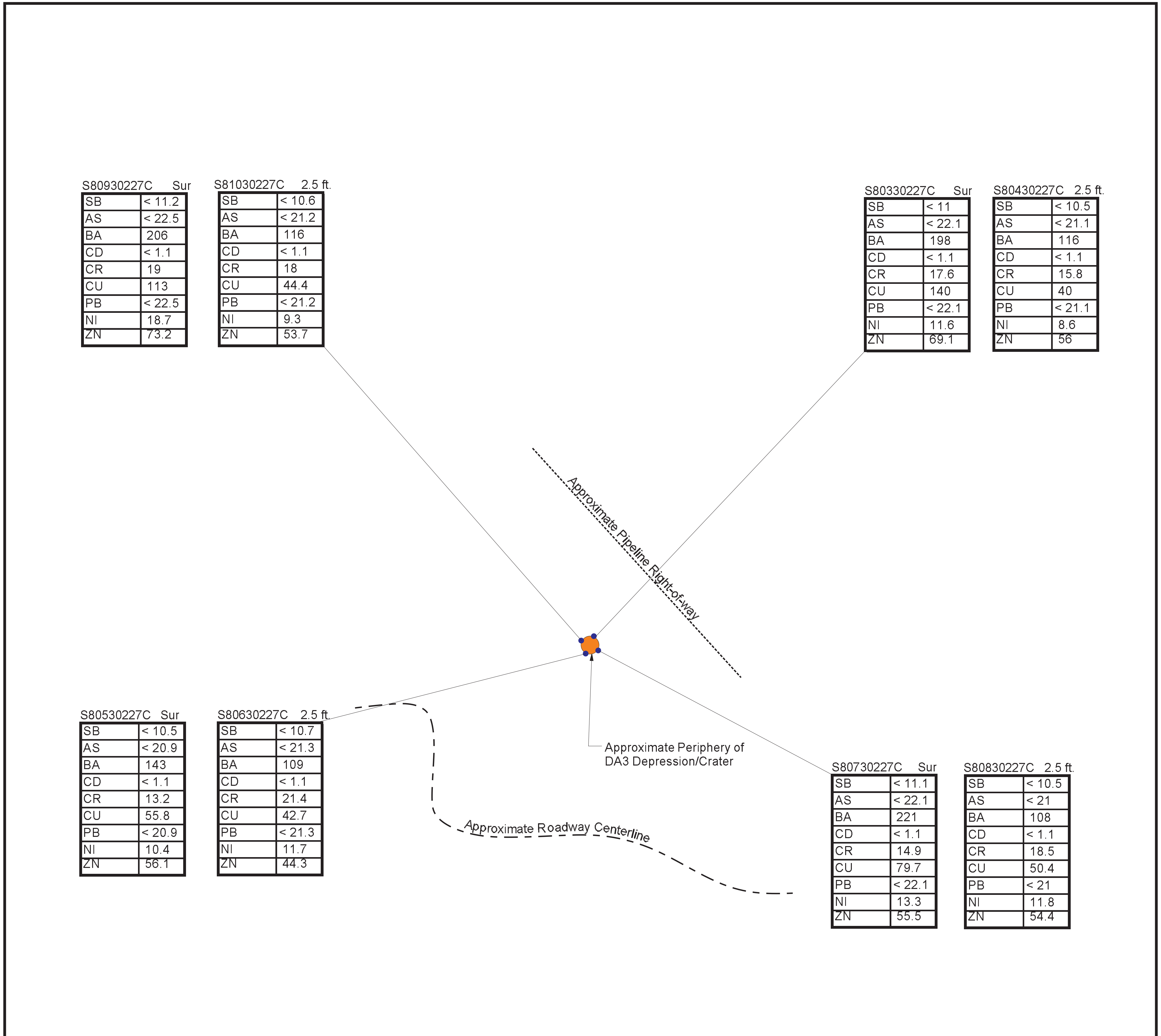


S80930227C Sur

SB	< 11.2
AS	< 22.5
BA	206
CD	< 1.1
CR	19
CU	113
PB	< 22.5
NI	18.7
ZN	73.2

S81030227C 2.5 ft.

SB	< 10.6
AS	< 21.2
BA	116
CD	< 1.1
CR	18
CU	44.4
PB	< 21.2
NI	9.3
ZN	53.7

S80330227C Sur

SB	< 11
AS	< 22.1
BA	198
CD	< 1.1
CR	17.6
CU	140
PB	< 22.1
NI	11.6
ZN	69.1

S80430227C 2.5 ft.

SB	< 10.5
AS	< 21.1
BA	116
CD	< 1.1
CR	15.8
CU	40
PB	< 21.1
NI	8.6
ZN	56

S80530227C Sur

SB	< 10.5
AS	< 20.9
BA	143
CD	< 1.1
CR	13.2
CU	55.8
PB	< 20.9
NI	10.4
ZN	56.1

S80630227C 2.5 ft.

SB	< 10.7
AS	< 21.3
BA	109
CD	< 1.1
CR	21.4
CU	42.7
PB	< 21.3
NI	11.7
ZN	44.3

S80730227C Sur

SB	< 11.1
AS	< 22.1
BA	221
CD	< 1.1
CR	14.9
CU	79.7
PB	< 22.1
NI	13.3
ZN	55.5

S80830227C 2.5 ft.

SB	< 10.5
AS	< 21
BA	108
CD	< 1.1
CR	18.5
CU	50.4
PB	< 21
NI	11.8
ZN	54.4

Figure B-31a

Camp Bonneville

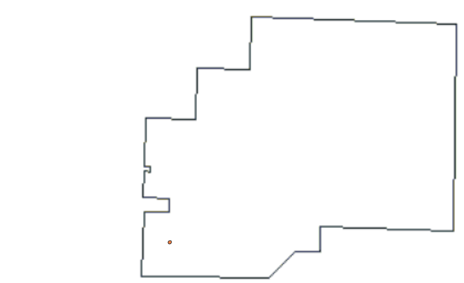
Vancouver, Washington

Delivery Order Number: DACA65-03-F-0002

Contract Number: GS-10F-0135M

Demolition Area 3 Priority Pollutant Metal Results by Method 6010 (mg/Kg)

Key Map



Legend

- Sampling Grid Center Point
- Demolition Area D2
- Sur Surface Sample

N
W E
S

Approximate Scale

200 0 100 200 400

1 inch = 200 ft.

August 15, 2003

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APPENDIX C

Summary Tables of Samples and Photographs

(Previously Submitted in electronic format on Compact Disk)

APPENDIX C ERRATA

1. The latitude and longitude coordinates of samples collected from the muzzle blast zone at the 25 Meter M60/Pistol range are as follows:

Sample Point ID	Latitude	Longitude
25M_M60-FP1	45.69760	-122.41173
25M_M60-FP2	45.69760	-122.41161
25M_M60-FP3	45.69760	-122.41144
25M_M60-FP4	45.69760	-122.51135
25M_M60-FP5	45.69765	-122.41124
25M_M60-FP6	45.69764	-122.41113

2. An "S" should appear in each space of the "Matrix" column (to complete the sample number) in the summary table for the Machine Gun Range (south, grid nos. 163 through 188).

3. Photographs of the following samples are not included in Appendix D:

Sample No.	Photograph No.	Range
S03130303S	0303031058P356	Sub Machine Gun Range
S06030226W	0226030937P080	Rifle Ranges 1 & 2
S06930226W	0226031355Q994	
S10930317C	0316031515Q314	Field Fire Rifle Ranges 1 & 2
S10930317N	0316031519Q317	
S10930317S	0316031516Q315	
S10930317E	0316031520Q318	
S10930317W	0316031517Q316	
S12230314S	0314030859Q055	1,000 Foot Range, 1,000 Foot Machine Gun and Moving Target Range
S13030310N	0310031606P816	
S14730312W	0312031556Q010	Combat Pistol Range
S20030307N	0307031411P436	Machine Gun Range

4. In Appendix D, photograph no. 0226031314P134 (sample no. S06830226C at Rifle Ranges 1 & 2) should be numbered 0226031314P131 as it is in the Appendix C summary table.

APPENDIX D

Sample Photographs

(Previously Submitted)

APPENDIX E

Laboratory Data Reports

(Previously Submitted)

Sample Index

Close Combat Range

Range	Grid No.	Report Number	Report Date
	001	K2301620	31-Mar-03
	002	K2301620	31-Mar-03
	003	K2301580	19-Mar-03
	004	K2301580	19-Mar-03
	005	K2301620	31-Mar-03
	006	K2301620	31-Mar-03
	007	K2301586	27-Mar-03
	008	K2301580	19-Mar-03
	009	K2301621	25-Mar-03
	010	K2301621	25-Mar-03
	011	K2301586	27-Mar-03
	012	K2301580	19-Mar-03
	013	K2301621	25-Mar-03
	014	K2301621	25-Mar-03
	015	K2301586	27-Mar-03
	016	K2301583	19-Mar-03
	017	K2301623	24-Mar-03
	018	K2301623	24-Mar-03
	019	K2301586	27-Mar-03
	020	K2301583	19-Mar-03
	021	K2301514	20-Mar-03
	022	K2301514	20-Mar-03
	023	K2301514	20-Mar-03
	024	K2301514	20-Mar-03

Sample Index

Range	Grid No.	Report Number	Report Date
25 Meter M60 Range/Pistol Range			
	601	K2301588	26-Mar-03
	602	K2301588	26-Mar-03
	603	K2301588	26-Mar-03
	604	K2301588	26-Mar-03
	605	K2301588	26-Mar-03
	606	K2301588	26-Mar-03
	025	K2301581	19-Mar-03
	026	K2301581	19-Mar-03
	027	K2301581	19-Mar-03
	028	K2301581	19-Mar-03
	320	K2301588	26-Mar-03
	321	K2301588	26-Mar-03
	322	K2301588	26-Mar-03

Sample Index

Range	Grid No.	Report Number	Report Date
Sub Machine Gun Range			
	029	K2301511	19-Mar-03
	030	K2301511	19-Mar-03
	031	K2301511	19-Mar-03
	032	K2301511	19-Mar-03
	033	K2301513	20-Mar-03
	034	K2301513	20-Mar-03
	035	K2301513	20-Mar-03
	323	K2301513	20-Mar-03
	324	K2301513	20-Mar-03
	325	K2301513	20-Mar-03

Sample Index

Range	Grid No.	Report Number	Report Date
TF Range			
	036	K2301744	31-Mar-03
	037	K2301744	31-Mar-03
	038	K2301745	31-Mar-03
		K2301759	01-Apr-03
	039	K2301744	31-Mar-03
	040	K2301744	31-Mar-03
		K2301759	01-Apr-03
	041	K2301745	31-Mar-03
	042	K2301745	31-Mar-03
	043	K2301745	31-Mar-03
	326	K2301748	02-Apr-03
	327	K2301759	01-Apr-03
	328	K2301759	01-Apr-03
	329	K2301748	02-Apr-03
	607	K2301748	02-Apr-03
	608	K2301748	02-Apr-03

Sample Index

Range	Grid No.	Report Number	Report Date
Rifle Ranges 1 & 2			
	609	K2301473	26-Mar-03
	610	K2301473	26-Mar-03
	611	K2301427	02-Apr-03
	612	K2301427	02-Apr-03
	613	K2301427	02-Apr-03
	614	K2301427	02-Apr-03
	615	K2301427	02-Apr-03
	044	K2301340	11-Mar-03
	045	K2301340	11-Mar-03
	046	K2301341	14-Mar-03
	047	K2301341	14-Mar-03
	048	K2301340	11-Mar-03
	049	K2301340	11-Mar-03
	050	K2301341	14-Mar-03
	051	K2301341	14-Mar-03
	052	K2301342	11-Mar-03
	053	K2301342	11-Mar-03
	054	K2301342	11-Mar-03
	055	K2301344	07-Mar-03
	056	K2301380	13-Mar-03
	057	K2301380	13-Mar-03
	058	K2301342	11-Mar-03
	059	K2301344	07-Mar-03
	060	K2301380	13-Mar-03
	061	K2301380	13-Mar-03
	062	K2301383	11-Mar-03
	063	K2301383	11-Mar-03
	064	K2301383	11-Mar-03
	065	K2301383	11-Mar-03
	066	K2301385	11-Mar-03
	067	K2301385	11-Mar-03
	068	K2301385	11-Mar-03
	069	K2301385	11-Mar-03
	070	K2301389	18-Mar-03
	071	K2301389	18-Mar-03
	072	K2301389	18-Mar-03
	073	K2301389	18-Mar-03
	074	K2301388	18-Mar-03
	075	K2301388	18-Mar-03
	330	K2301344	07-Mar-03
	331	K2301344	07-Mar-03
	332	K2301344	07-Mar-03
	333	K2301344	07-Mar-03
	334	K2301344	07-Mar-03
	335	K2301344	07-Mar-03
	336	K2301388	18-Mar-03
	337	K2301344	07-Mar-03
	338	K2301388	18-Mar-03
	339	K2301388	18-Mar-03

Sample Index

Range	Grid No.	Report Number	Report Date
	340	K2301388	18-Mar-03
	341	K2301388	18-Mar-03
	342	K2301388	18-Mar-03
	343	K2301388	18-Mar-03
	344	K2301388	18-Mar-03
	345	K2301388	18-Mar-03
	468	K2301430	26-Mar-03

Sample Index

Range	Grid No.	Report Number	Report Date
Field Fire Rifle Range 1 & 2			
	616	K2301473	26-Mar-03
	617	K2301473	26-Mar-03
	076	K2301473	26-Mar-03
	077	K2301504	19-Mar-03
	078	K2301473	26-Mar-03
	079	K2301474	20-Mar-03
	080	K2301474	20-Mar-03
	081	K2301503	19-Mar-03
	082	K2301474	20-Mar-03
	083	K2301474	20-Mar-03
	084	K2301477	19-Mar-03
	085	K2301477	19-Mar-03
	086	K2301477	19-Mar-03
	087	K2301477	19-Mar-03
	088	K2301478	20-Mar-03
	089	K2301478	20-Mar-03
	090	K2301478	20-Mar-03
	091	K2301478	20-Mar-03
	092	K2301479	19-Mar-03
	093	K2301503	19-Mar-03
	094	K2301479	19-Mar-03
	095	K2301480	18-Mar-03
	096	K2301503	19-Mar-03
	097	K2301503	19-Mar-03
	346	K2301479	19-Mar-03
	347	K2301479	19-Mar-03
	348	K2301479	19-Mar-03
	349	K2301479	19-Mar-03
	350	K2301479	19-Mar-03
	351	K2301479	19-Mar-03
	352	K2301479	19-Mar-03
	353	K2301479	19-Mar-03
	354	K2301479	19-Mar-03
	355	K2301479	19-Mar-03
	356	K2301505	19-Mar-03

Sample Index

Range	Grid No.	Report Number	Report Date
Infiltration Course North			
	618	K2301506	26-Mar-03
	619	K2301506	26-Mar-03
	098	K2301504	19-Mar-03
	099	K2301504	19-Mar-03
	100	K2301505	19-Mar-03
	101	K2301505	19-Mar-03
	357	K2301505	19-Mar-03
	358	K2301505	19-Mar-03

Sample Index

Range	Grid No.	Report Number	Report Date
Undocumented Pistol Range			
	307	K2301505	19-Mar-03
	665	K2301506	26-Mar-03
	666	K2301506	26-Mar-03
	667	K2301506	26-Mar-03
	668	K2301506	26-Mar-03
	669	K2301506	26-Mar-03

Range	Grid No.	Report Number	Report Date
Combat Pistol Range			
	626	K2301962	02-Apr-03
	627	K2301962	02-Apr-03
	628	K2301962	02-Apr-03
	629	K2301962	02-Apr-03
	630	K2301962	02-Apr-03
	631	K2301962	02-Apr-03
	146	K2301957	02-Apr-03
	147	K2301865	31-Mar-03
	148	K2301957	02-Apr-03
	149	K2301865	31-Mar-03
	150	K2301960	02-Apr-03
	151	K2301865	31-Mar-03
	152	K2301865	31-Mar-03
	153	K2301957	02-Apr-03
	154	K2301957	02-Apr-03
	155	K2301959	02-Apr-03
	156	K2301959	02-Apr-03
	157	K2301959	02-Apr-03
	158	K2301959	02-Apr-03
	159	K2301959	02-Apr-03
	160	K2301960	02-Apr-03
	161	K2301960	02-Apr-03
	162	K2301960	02-Apr-03
	308	K2301623	24-Mar-03
	309	K2301588	26-Mar-03
	310	K2301623	24-Mar-03
	312	K2301623	24-Mar-03
	313	K2301588	26-Mar-03
	314	K2301623	24-Mar-03
	315	K2301588	26-Mar-03
	316	K2301623	24-Mar-03
	317	K2301588	26-Mar-03
	318	K2301513	20-Mar-03
	319	K2301513	20-Mar-03
	382	K2301962	02-Apr-03
	383	K2301962	02-Apr-03
	384	K2301962	02-Apr-03
	385	K2301869	02-Apr-03
	386	K2301962	02-Apr-03
	387	K2301962	02-Apr-03
	388	K2301962	02-Apr-03
	389	K2301962	02-Apr-03
	390	K2301962	02-Apr-03
	469	K2301962	02-Apr-03

Sample Index

Range	Grid No.	Report Number	Report Date
Machine Gun - North			
	189	K2301789	31-Mar-03
	190	K2301789	31-Mar-03
	191	K2301789	31-Mar-03
	192	K2301789	31-Mar-03
	193	K2301790	01-Apr-03
	194	K2301748	02-Apr-03
	195	K2301747	31-Mar-03
	196	K2301790	01-Apr-03
	197	K2301790	01-Apr-03
	198	K2301746	31-Mar-03
	199	K2301748	02-Apr-03
	200	K2301746	31-Mar-03
	201	K2301747	31-Mar-03
	202	K2301746	31-Mar-03
	203	K2301747	31-Mar-03
	204	K2301747	31-Mar-03
	205	K2301790	01-Apr-03
	206	K2301792	04-Apr-03
	207	K2301792	04-Apr-03
	208	K2301746	31-Mar-03
	209	K2301790	01-Apr-03
	210	K2301792	04-Apr-03
	211	K2301792	04-Apr-03
	212	K2301793	31-Mar-03
	213	K2301793	31-Mar-03
	214	K2301793	31-Mar-03
	215	K2301793	31-Mar-03
	216	K2301795	31-Mar-03
	217	K2301795	31-Mar-03
	218	K2301795	31-Mar-03
	219	K2301795	31-Mar-03
	220	K2301796	02-Apr-03
	221	K2301796	02-Apr-03
	404	K2301796	02-Apr-03
	405	K2301796	02-Apr-03
	406	K2301796	02-Apr-03
	407	K2301748	02-Apr-03
	408	K2301796	02-Apr-03
	409	K2301748	02-Apr-03
	410	K2301748	02-Apr-03
	411	K2301748	02-Apr-03
	412	K2301796	02-Apr-03
	413	K2301796	02-Apr-03
	414	K2301796	02-Apr-03
	415	K2301796	02-Apr-03
	416	K2301796	02-Apr-03
	417	K2301796	02-Apr-03
	418	K2301796	02-Apr-03
	419	K2301796	02-Apr-03

Sample Index

Range	Grid No.	Report Number	Report Date

Sample Index

Range	Grid No.	Report Number	Report Date
Machine Gun - South			
	163	K2302012	02-Apr-03
	164	K2302012	02-Apr-03
	165	K2302012	02-Apr-03
	166	K2302012	02-Apr-03
	167	K2302013	03-Apr-03
	168	K2302013	03-Apr-03
	169	K2302013	03-Apr-03
	170	K2302067	03-Apr-03
	171	K2302067	03-Apr-03
	172	K2302067	03-Apr-03
	173	K2302067	03-Apr-03
	174	K2302067	03-Apr-03
	175	K2302070	03-Apr-03
	176	K2302070	03-Apr-03
	177	K2302072	04-Apr-03
	178	K2302070	03-Apr-03
	179	K2302070	03-Apr-03
	180	K2302072	04-Apr-03
	181	K2302072	04-Apr-03
	182	K2302072	04-Apr-03
	183	K2302077	03-Apr-03
	184	K2302077	03-Apr-03
	185	K2302077	03-Apr-03
	186	K2302077	03-Apr-03
	187	K2302078	04-Apr-03
	188	K2302078	04-Apr-03
	391	K2302014	04-Apr-03
	392	K2302014	04-Apr-03
	393	K2302014	04-Apr-03
	394	K2302014	04-Apr-03
	395	K2302078	04-Apr-03
	396	K2302078	04-Apr-03
	397	K2302078	04-Apr-03
	398	K2302078	04-Apr-03
	399	K2302078	04-Apr-03
	400	K2302078	04-Apr-03
	401	K2302078	04-Apr-03
	402	K2302078	04-Apr-03
	403	K2302078	04-Apr-03

Sample Index

Range	Grid No.	Report Number	Report Date
M31 Sub-Caliber Ranges 1 & 2			
	633	K2302082	04-Apr-03
	634	K2302082	04-Apr-03
	635	K2302082	04-Apr-03
	636	K2302082	04-Apr-03
	637	K2302082	04-Apr-03
	638	K2302082	04-Apr-03
	222	K2302109	03-Apr-03
	223	K2302109	03-Apr-03
	224	K2302109	03-Apr-03
	225	K2302111	03-Apr-03
	226	K2302111	03-Apr-03
	227	K2302109	03-Apr-03
	228	K2302143	04-Apr-03
	229	K2302143	04-Apr-03
	230	K2302143	04-Apr-03
	231	K2302143	04-Apr-03
	232	K2302144	04-Apr-03
	233	K2302144	04-Apr-03
	234	K2302111	03-Apr-03
	235	K2302144	04-Apr-03
	236	K2302111	03-Apr-03
	237	K2302112	04-Apr-03
	238	K2302112	04-Apr-03
	239	K2302112	04-Apr-03
	240	K2302112	04-Apr-03
	241	K2302115	03-Apr-03
	242	K2302115	03-Apr-03
	243	K2302115	03-Apr-03
	244	K2302117	03-Apr-03
	245	K2302117	03-Apr-03
	246	K2302082	04-Apr-03
	420	K2302124	04-Apr-03
	421	K2302124	04-Apr-03
	422	K2302124	04-Apr-03
	423	K2302144	04-Apr-03
	424	K2302144	04-Apr-03
	425	K2302144	04-Apr-03
	426	K2302124	04-Apr-03
	427	K2302124	04-Apr-03
	428	K2302124	04-Apr-03
	429	K2302124	04-Apr-03
	430	K2302124	04-Apr-03
	431	K2302124	04-Apr-03
	432	K2302078	04-Apr-03

Sample Index

Range	Grid No.	Report Number	Report Date
25 Meter and Machine Gun Range			
	639	K2301687	02-Apr-03
	640	K2301687	02-Apr-03
	641	K2301687	02-Apr-03
	642	K2301687	02-Apr-03
	643	K2301687	02-Apr-03
	644	K2301687	02-Apr-03
	645	K2301687	02-Apr-03
	646	K2301687	02-Apr-03
	647	K2301687	02-Apr-03
	648	K2301687	02-Apr-03
	247	K2301684	02-Apr-03
	248	K2301684	02-Apr-03
		K2301680	24-Mar-03
	249	K2301680	24-Mar-03
	250	K2301680	24-Mar-03
		K2301684	02-Apr-03
	251	K2301680	24-Mar-03
	252	K2301678	24-Mar-03
		K2301680	24-Mar-03
	253	K2301690	24-Mar-03
	254	K2301676	24-Mar-03
		K2301690	24-Mar-03
	255	K2301676	24-Mar-03
	256	K2301676	24-Mar-03
		K2301678	24-Mar-03
	257	K2301678	24-Mar-03
	258	K2301678	24-Mar-03
		K2301690	24-Mar-03
	259	K2301678	24-Mar-03
	433	K2301684	02-Apr-03
	434	K2301684	02-Apr-03
	435	K2301684	02-Apr-03
	436	K2301684	02-Apr-03
	437	K2301684	02-Apr-03
	438	K2301684	02-Apr-03
	439	K2301684	02-Apr-03
	440	K2301684	02-Apr-03

Sample Index

Range	Grid No.	Report Number	Report Date
Infiltration course - South			
	649	K2301687	02-Apr-03
	650	K2301687	02-Apr-03
	651	K2301687	02-Apr-03
	652	K2301687	02-Apr-03
	653	K2301687	02-Apr-03
	654	K2301687	02-Apr-03
	655	K2301687	02-Apr-03
	656	K2301687	02-Apr-03
	657	K2301687	02-Apr-03
	658	K2301687	02-Apr-03
	659	K2301687	02-Apr-03
	660	K2301687	02-Apr-03
	661	K2301687	02-Apr-03
	662	K2301687	02-Apr-03
	260	K2301690	24-Mar-03
	261	K2301690	24-Mar-03
	262	K2301689	24-Mar-03
	263	K2301689	24-Mar-03
	264	K2301689	24-Mar-03
	265	K2301689	24-Mar-03
	266	K2301676	24-Mar-03
	441	K2301684	02-Apr-03
	442	K2301684	02-Apr-03
	443	K2301684	02-Apr-03
	444	K2301684	02-Apr-03
	445	K2301684	02-Apr-03

Sample Index

Range	Grid No.	Report Number	Report Date
Background			
	501	K2301308	11-Mar-03
	502	K2301583	19-Mar-03
	503	K2301583	19-Mar-03
	504	K2301308	11-Mar-03
	505	K2301308	11-Mar-03
	506	K2302144	04-Apr-03
	507	K2302144	04-Apr-03
	508	K2301759	01-Apr-03
	509	K2302144	04-Apr-03
	510	K2302144	04-Apr-03
	511	K2302144	04-Apr-03
	512	K2301583	19-Mar-03
	513	K2301583	19-Mar-03
	514	K2301583	19-Mar-03
	515	K2301583	19-Mar-03
	516	K2302144	04-Apr-03
	517	K2302144	04-Apr-03
	518	K2301308	11-Mar-03
	519	K2301308	11-Mar-03
	520	K2301983	04-Apr-03

Sample Index

Range	Grid No.	Report Number	Report Date
Demolition Area 2			
	701	K2301427	02-Apr-03
	702	K2301427	02-Apr-03
	704	K2301427	02-Apr-03
	705	K2301427	02-Apr-03
	707	K2301427	02-Apr-03
	708	K2301427	02-Apr-03
	709	K2301427	02-Apr-03
	710	K2301427	02-Apr-03
	711	K2301427	02-Apr-03
	712	K2301427	02-Apr-03
	713	K2301427	02-Apr-03
	714	K2301427	02-Apr-03
	716	K2301427	02-Apr-03
	717	K2301427	02-Apr-03
	718	K2301427	02-Apr-03
	466	K2301430	26-Mar-03
	470	K2301430	26-Mar-03
	DA2	K2302189	02-Apr-03

Sample Index

Range	Grid No.	Report Number	Report Date
Demolition Area 3			
	467	K2301430	26-Mar-03
	803	K2301430	26-Mar-03
	804	K2301430	26-Mar-03
	805	K2301430	26-Mar-03
	806	K2301430	26-Mar-03
	807	K2301430	26-Mar-03
	808	K2301430	26-Mar-03
	809	K2301430	26-Mar-03
	810	K2301430	26-Mar-03

APPENDIX F

Manifests for Disposal of IDW

Corporate Office
[illegible]

Vopak

Generator's Waste Profile (GWP)

Disposal Facility
[illegible]

I. GENERAL INFORMATION

A. Generator name: Camp Bonneville
B. Generator address: Camp Bonneville, Range Control Headquarters, Bldg [illegible], Vancouver, Washington
C. Generator contact: Steve Hartung
D. Generator EPA ID No.: WA8 000 016 972
E. Generator State ID No.:
F. Generator State Waste Code No.:

G. [illegible]: Univar USA, Inc
H. [illegible]: [illegible]
I. [illegible]: [illegible]
J. [illegible] Phone No.: [illegible]
K. Generator Phone No.: 360 694 0332
L. [illegible]: Christian Sewell

II. WASTE INFORMATION - [illegible]

A. Name of waste stream: Decontamination Water
B. Describe the process generating waste: Decontaminating Sampling Equipment
C. Volume: ~10 gallons
D. Frequency: 1 Time
E. Sample source:
F. Waste container (truck, drum): 20 gallon Drum

III. PHYSICAL CHARACTERISTICS OF WASTE STREAM

A. Flashpoint:
B. pH:
C. Density: N/A
D. Color/appearance: Clear
E. [illegible]: 0%
F. Odor: N/A - none
G. Physical state: Water
H. [illegible]: [illegible]
I. [illegible] value: N/A

IV. CHEMICAL COMPOSITION - CONSTITUENTS DO NOT USE GENERIC TERMS (e.g. ORGANICS, SALT, SOLIDS, OILS) ATTACH MSDS FOR PRODUCTS

Constituent		Constituent	
H_2O	80-99%	Di Nitrate Toluene	4-20 ppm

[illegible]

V. WASTE CONTENT - PLEASE INDICATE IF THE WASTE CONTAINS ANY OF THE FOLLOWING (ATTACH ANALYTICAL WHERE APPLICABLE)

[illegible]

VI. RCRA CHARACTERIZATION

[illegible]

VII. ADDITIONAL INFORMATION AND HEALTH & SAFETY PRECAUTIONS

[illegible]

Signature: [signature] Steve Hartung Date: 13 June 2003

[illegible]

** TOTAL PAGE.02 **

Corporate Office
Vopak Industrial Services USA Inc.
2000 West Loop South, Suite 2200
Houston, Texas 77027
PHONE: (713) 623-0000
FAX: (713) 561-7322

Vopak

Generator's Waste Profile (GWP)

Disposal Facility
Vopak Industrial Services Deer Park Inc.
2759 Battleground Road
Deer Park, Texas 77536
PHONE: (281) 604-6150
LAB FAX: (281) 604-6178
Customer Service Fax: (281) 604-6106
e-mail: vis_gep@vopak.com

I. GENERAL INFORMATION

A. GENERATOR NAME: Camp Bonneville
B. GENERATOR ADDRESS: Camp Bonneville Range Control Headquarters, Bldg. T4398 Vancouver, Washington
C. GENERATOR CONTACT: Steve Hartung
D. GENERATOR EPA ID NO.:
E. GENERATOR STATE ID NO.:
F. GENERATOR STATE WASTE CODE NO.:
G. BILLING NAME: UNIVAR USA, Inc.
H. BILLING ADDRESS: 8201 South 212th Kent, WA 98032
I. BILLING: Linda Wimmer
J. BILLING PHONE NO.: (253) 872-5062
K. GENERATOR PHONE NO.: 360 694 0332
L. VOPAK SALES CONTACT: Christian Jewels

II. WASTE INFORMATION - PLEASE USE FULL NAMES RATHER THAN

A. NAME OF WASTE STREAM: Decontamination Water
B. DESCRIBE THE PROCESS GENERATING WASTE: Decontaminating Sampling equipment
C. VOLUME: ≈ 10 gallons
D. FREQUENCY: 1 Time
E. SAMPLE SOURCE:
F. WASTE CONTAINER (TRUCK, DRUM: 20 gallon Drum

III. PHYSICAL CHARACTERISTICS OF WASTE STREAM

A. FLASHPOINT: F
B. pH:
C. DENSITY (lb/GAL OR S.G.): n/A
D. COLOR/APPEARANCE: Clear
E. SOLIDS (%): 0%
F. ODOR: n/A - none
G. PHYSICAL STATE: Water
H. PHASES/LAYERS: ✓ SINGLE __ MULTIPLE
I. BTU VALUE: n/A

IV. CHEMICAL COMPOSITION-CONSTITUENTS DO NOT USE GENERIC TERMS (e.g. ORGANICS, SALT, SOLIDS, OILS)-ATTACH MSDS FOR PRODUCTS

Constituent	%	ppm	Constituent	%	ppm
H_2O	80-99%		DiNitrate Toluene*		4-20 ppm

(* Indicates TX Listed Chemical) Total ____ % (Must be >= 100%)

V. WASTE CONTENT - PLEASE INDICATE IF THE WASTE CONTAINS ANY OF THE FOLLOWING (ATTACH ANALYTICAL WHERE APPLICABLE)

SULFIDE ___ ppm	__ YES X NO	RADIOACTIVE ?	__ YES X NO	BENZENE NESHAP WASTE? (40 CFR 61 SUBPART FF)	__ YES X NO
CYANIDE ___ ppm	__ YES X NO	PCB'S >50 ppm ?	__ YES X NO	VOC LESS THAN 500 ppmw? (40 CFR 264 SUBPART CC)	__ YES X NO
BENZENE ___ ppm	__ YES X NO	PCB TSCA WASTE?	__ YES X NO		
PESTICIDE/HERBICIDE	__ YES X NO	DIOXINS ?	__ YES X NO	NON WASTEWATER STREAM? (40 CFR 63 SUBPART G)	__ YES X NO
EXPLOSIVE MATERIAL	__ YES X NO				

VI. RCRA CHARACTERIZATION

A. THIS MATERIAL IS A __ WASTEWATER (<1% TOC AND <1% TSS) X NONWASTEWATER (>=1% TOC AND >=1% TSS)
B. IS THIS A USEPA HAZARDOUS WASTE (40 CFR PART 261)? __ YES X NO State of Texas UNIVERSAL WASTE (30 TAC 335.261)? __ YES X NO
C. IF B IS YES, LIST ALL EPA WASTE CODE NUMBERS (D, F, K, P, U)

VII. ADDITIONAL INFORMATION AND HEALTH & SAFETY PRECAUTIONS

Generator wishes to PROHIBIT management of this waste stream by __ Underground Injection; or Subtitle C/D Landfill

Generator waste disposal preference __ Waste water treatment __ Underground injection __ Incineration __ Landfill (list order of preference 1, 2, NO, etc.

VIII. GENERATOR'S CERTIFICATION

SIGNATURE PRINTED (OR TYPED) NAME & TITLE DATE

THE SAMPLE SUBMITTED IS REPRESENTATIVE AS DEFINED IN 40CFR261-APPENDIX I. I HEREBY CERTIFY THAT THE ABOVE AND ATTACHED DESCRIPTION IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE AND ABILITY TO DETERMINE THAT NO DELIBERATE OR WILLFUL OMISSIONS OF COMPOSITION OR PROPERTIES EXIST AND THAT ALL KNOWN OR SUSPECTED HAZARDS HAVE BEEN DISCLOSED. I AUTHORIZE VOPAK TO OBTAIN A SAMPLE FROM ANY WASTE SHIPMENT FOR PURPOSES OF RECERTIFICATION.

Profile Approval

Profile Temp Usage #: gtpw082

Please print or type
(Form designed for use on elite (12-pitch) typewriter.)

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. WAH000016972 | Manifest Doc. No. 50010 | 2. Page 1 of 1

3. Generator's Name and Mailing Address
CAMP Bonneville - Range Control Headquarters
Bldg # T4398 Vancouver, WA

4. Generator's Phone (360) 694 0332

5. Transporter 1 Company Name: Rivers Edge Services | 6. US EPA ID Number: WAH000010314 | A. Transporter's Phone: 253 872 8988

7. Transporter 2 Company Name | 8. US EPA ID Number | B. Transporter's Phone

9. Designated Facility Name and Site Address | 10. US EPA ID Number | C. Facility's Phone

11. Waste Shipping Name and Description	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol
a. SAMPLING GEAR - SOLID WASTE - RCRA Subtitle D Disposal - non Reg.	003	SS	00003	
b.				
c.				
d.				

D. Additional Descriptions for Materials Listed Above

n/A

E. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

n/A

16. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name: Steve Spencer (AGENT) | Signature: | Month 06 Day 06 Year 03

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Robert J. Kemp | Signature: | Month 06 Day 6 Year 03

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month | Day | Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name: Steve Spencer | Signature: | Month 06 Day 13 Year 03

GENERATOR / TRANSPORTER / FACILITY

Printed by J. J. KELLER & ASSOCIATES, INC. Neenah, WI 54957-0368

ORIGINAL – RETURN TO GENERATOR

#255090

Please print or type
(Form designed for use on elite (12-pitch) typewriter)

Emergency Contact Telephone Number

Form Approved. OMB No. 2050-0039. Expires 9-30-99

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. WAH000001697721
Manifest Document No. 0010
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Camp Bonneville - Range Control Headquarters
Build # T4398

4. Generator's Phone (360) 694 0332

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name
RiversEdge Services/EMS

6. US EPA ID Number
WAH000010314

C. State Transporter's ID

D. Transporter's Phone

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address
Univar USA Inc.
8201 S. 212th
Kent, WA 98032

10. US EPA ID Number
WAD067548966

G. State Facility's ID

H. Facility's Phone

HM	11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
	a. Di-Nitro Toluene Water	001	10	10991	20B	
	b.					
	c.					
	d.					

J. Additional Descriptions for Materials Listed Above
N/A

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
N/A

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national governmental regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: Steve Spencer (Agent)
Signature:
Month Day Year: 06 16 03

GENERATOR

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Robert S. Kemp
Signature:
Month Day Year: 06 16 03

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

TRANSPORTER

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Steve Hibben
Signature:
Month Day Year: 06 30 03

FACILITY

RECYCLING/TSD HANDLING AGREEMENT

Vopak Industrial Services USA Inc.

(GENERATOR AND RECYCLING/TSD CONTRACTOR)

ChemCare

WHEREAS, Generator produces spent chemicals which may be considered to be "hazardous" or "toxic" within the meaning of applicable federal and state laws ("Spent Chemicals") and which therefore must be transported, stored, disposed of, recycled, treated or re-used ("Handled") in accordance with applicable laws pertaining to hazardous or toxic chemicals.

WHEREAS, Recycling/TSD Contractor owns or controls facilities which are capable of Handling spent Chemicals in accordance with all applicable laws pertaining to such activities;

WHEREAS, the parties desire to enter into an arrangement for the Handling of Spent Chemicals, all on the terms and conditions hereinafter set forth;

NOW, THEREFORE, in consideration of the covenants and agreements contained herein, the undersigned agree to the following terms and conditions of this Recycling/TSD Handling Agreement as well as to the Standard Terms and Conditions Governing the Handling of Spent Chemicals ("Standard Terms and Conditions"), which are attached to the Generator copy of this Agreement and are incorporated herein by reference. All capitalized terms not otherwise defined herein shall have the meanings set forth in the Standard Terms and Conditions.

1. **SPENT CHEMICALS SHIPMENT.** The completed Uniform Hazardous Waste Manifest or appropriate state manifest which is identified by the reference number appearing in a space below the signatures to this agreement and which pertains to the Spent Chemicals Shipment Handled under this Agreement is hereby incorporated herein by reference. Such manifest describes certain Spent Chemicals which Generator hereby agrees to ship to Recycling/TSD Contractor and which Recycling/TSD Contractor agrees to handle at the facility named in such manifest ("Designated Facility").

2. **COLLECTION, TRANSPORTATION, STORAGE AND DELIVERY.** All Spent Chemicals Shipments shall be transported to Recycling/TSD Contractor by Univar USA Inc., a Washington Corporation ("Univar USA"), or an entity designated by Univar USA to provide transportation and temporary storage services.

3. **PAYMENT.** It is understood that Univar USA shall pay Recycling/TSD Contractor for Handling the Spent Chemicals Shipment (or, where money is owed to Generator, Univar USA shall pay Generator for the Spent Chemicals Shipment) according to the terms of a certain Master Spent Chemicals Handling Agreement between Recycling/TSD Contractor and Univar USA. Recycling/TSD Contractor shall not look to Generator for payment for Handling the Spent Chemicals Shipment, except for certain extraordinary charges incurred in connection with Non-conforming Spent Chemicals as set forth in the Standard Terms and Conditions.

4. **INDEMNIFIED PARTY.** As used in the Standard Terms and Conditions, the term "Indemnified Party" shall mean either Recycling/TSD Contractor or Generator, depending upon which party claims indemnification under this Agreement.

5. **GENERATOR INDEMNIFICATION.** Generator shall defend, indemnify and hold harmless Recycling/TSD Contractor, its past, present and future officers, directors, employees, agents, insurers, and successors (hereinafter in this Paragraph referred to collectively as "Recycling/TSD Contractor") from and against any and all loss which Recycling/TSD Contractor may sustain or incur, be responsible for or pay out as a result of:

(a) Generator's breach of any representation, warranty, term or provision of this Agreement; or

(b) The negligence or intentional misconduct of Generator, its employees, agents, representatives or subcontractors in the performance of this Agreement, provided that such indemnification shall not apply to the extent such liabilities result from Recycling/TSD Contractor's negligence or intentional misconduct or from a breach of this Agreement by Recycling/TSD Contractor.

6. **NAMES AND ADDRESSES OF PERSONS TO WHOM NOTICE IS TO BE GIVEN.** The name of the person to whom notice is to be given on behalf of Generator appears on the Uniform Hazardous Waste Manifest in Item 16 or the appropriate state manifest. The name of the person to whom notice is to be given on behalf of Recycling/TSD Contractor appears on the Uniform Hazardous Waste manifest in Item 20 or the appropriate state manifest. The addresses of the persons to whom notice is to be given appear on the Uniform Hazardous Waste Manifest under Item 3 (for Generator) and Item 9 (for Recycling/TSD Contractor) or the appropriate state manifest.

RECYCLING/TSD HANDLING AGREEMENT

(GENERATOR AND RECYCLING/TSD CONTRACTOR)

The undersigned hereby agree that, upon execution of this Recycling/TSD Handling Agreement, there is a binding contract between them according to the above terms and conditions, as of the day and year appearing below.

GENERATOR EPA ID# WAH 000016972

FACILITY Camp Bonneville

PRINT NAME: Steve Spencer TITLE: AGENT

SIGNATURE: [signature] DATE: 6-30-03

RECYCLING/TSD CONTRACTOR:

PRINT NAME: Michael J. Dilick TITLE: Vice President and General Manager

SIGNATURE: [signature]

RECYCLING/TSD CONTRACTOR SHIPMENT APPROVAL NUMBER

UNIFORM HAZARDOUS WASTE MANIFEST DOCUMENT NUMBER: 1 0 0 1 0

VS- 32940 -C

STATE HAZARDOUS WASTE MANIFEST DOCUMENT NUMBER:

Corporate Office
Vopak Industrial Services USA Inc.
2000 West Loop South, Suite 2200
Houston, Texas 77027
PHONE: (713) 625-0000
FAX: (713) 561-7022

Vopak

Generator's Waste Profile (GWP)

Disposal Facility
Vopak Industrial Services Deer Park Inc.
2759 Battleground Road
Deer Park, Texas 77536
PHONE: (281) 604-6150
FAX: (281) 604-6179

I. GENERAL INFORMATION

A. GENERATOR NAME: Camp Bonneville
B. GENERATOR ADDRESS: Camp Bonneville Range Control Headquarters, Bldg T-4599 Vancouver, Washington
C. GENERATOR CONTACT: Steve Hartung
D. GENERATOR EPA ID NO: WAH 000 016 972
E. GENERATOR STATE ID NO.:
F. GENERATOR STATE WASTE CODE NO.:

G. BILLING NAME: UNIVAR USA, Inc
H. BILLING ADDRESS: 8201 South 212th
Kent, WA 98032
I. BILLING: Linda Wimmer
J. BILLING PHONE NO.: (253) 872-5002
K. GENERATOR PHONE NO.: 360 694 0332
L. VOPAK SALES CONTACT: Christian Jewels

II. WASTE INFORMATION - PLEASE USE FULL NAMES RATHER THAN

A. NAME OF WASTE STREAM: Decontamination Water
B. DESCRIBE THE PROCESS GENERATING WASTE: Decontaminating Sampling Equipment
C. VOLUME: ≈ 10 gallons
D. FREQUENCY: 1 Time
E. SAMPLE SOURCE:
F. WASTE CONTAINER (TRUCK, DRUM): 20 gallon Drum

III. PHYSICAL CHARACTERISTICS OF WASTE STREAM

A. FLASHPOINT: °F
B. pH:
C. DENSITY (LBS/GAL OR S.G.): n/A
D. COLOR/APPEARANCE: Clear
E. SOLIDS (%): 0%
F. ODOR: n/A - none
G. PHYSICAL STATE: water
H. PHASES/LAYERS: ✓ SINGLE _ MULTIPLE
I. BTU VALUE: n/A

IV. CHEMICAL COMPOSITION-CONSTITUENTS DO NOT USE GENERIC TERMS (e.g. ORGANICS, SALT, SOLIDS, OIL) - ATTACH MSDS FOR PRODUCTS

Constituent	% / ppm	Constituent	% / ppm
H_2O	80-99%	Dinitrotoluene	4-20 ppm

Total % of Listed Chemicals: Total

V. WASTE CONTENT - PLEASE INDICATE IF THE WASTE CONTAINS ANY OF THE FOLLOWING (ATTACH ANALYTICAL WHERE APPLICABLE)

SULFIDE ___ ppm _ YES X NO	RADIOACTIVE? _ YES X NO	BENZENE NESHAP WASTE? (40 CFR 61 SUBPART FF) _ YES X NO
CYANIDE ___ ppm _ YES X NO	PEARS/bio agent? _ YES X NO	VOC (LESS THAN 500 ppmw?) (40 CFR 264 SUBPART CC) _ YES X NO
BENZENE ___ ppm _ YES X NO	PCB TSCA WASTE? _ YES X NO	
PESTICIDE/HERBICIDE _ YES X NO	DIOXINS? _ YES X NO	NEW WASTEWATER STREAM? (40 CFR 63 SUBPART DD) _ YES X NO
SHOCK SENSITIVE MATERIAL _ YES X NO		

VI. RCRA CHARACTERIZATION

A. THIS MATERIAL IS A _ HAZARDOUS WASTE (WITH TSD AND WITH TSD) X NON-HAZARDOUS (WITH TSD AND WITH TSD)
B. IS THIS A LISTED HAZARDOUS WASTE (40 CFR PART 261)? _ YES X NO State of Texas Universal Waste (30 TAC 335.261)? _ YES X NO
C. IF YES, LIST ALL EPA WASTE CODE NUMBERS (D, F, K, P, U)

VII. ADDITIONAL INFORMATION AND HEALTH & SAFETY PRECAUTIONS

Generator wishes to PROHIBIT management of this waste stream by: _ Underground injection, or _ Subtitle C/D Landfill
_ Commercial Subtitle C/D landfill _ Incineration _ Deep-well injection (List in the order of preference 1, 2, 3, etc.)

VIII. GENERATOR'S CERTIFICATION

Steve Hartung Steve Hartung 13 June 2003
SIGNATURE PRINTED (OR TYPED) NAME & TITLE DATE

THE SAMPLE SUBMITTED IS REPRESENTATIVE AS DEFINED IN 40CFR261 APPENDIX I. I HEREBY CERTIFY THAT THE ABOVE AND ATTACHED DESCRIPTION IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE AND ABILITY TO DETERMINE THAT NO DELIBERATE OR WILLFUL OMISSIONS OF COMPOSITION OR PROPERTIES EXIST AND THAT ALL KNOWN OR SUSPECTED HAZARDS HAVE BEEN DISCLOSED. I AUTHORIZE VOPAK TO OBTAIN A SAMPLE FROM ANY WASTE SHIPMENT FOR PURPOSES OF RECERTIFICATION.

Corporate Office
Vopak Industrial Services USA Inc.
2000 West Loop South, Suite 2200
Houston, Texas 77027
PHONE. (713) 623-0000
FAX. (713) 561-7322

Vopak

Generator's Waste Profile (GWP)

Disposal Facility
Vopak Industrial Services Deer Park Inc
2758 Battleground Road
Deer Park, Texas 77536
PHONE: (281) 604-0150
LAB FAX (281) 604-0178
Customer Service Fax: (281) 604-0100
e-mail: vis_gcs@vopak.com

I. GENERAL INFORMATION

A. GENERATOR NAME: Camp Bonneville
B. GENERATOR ADDRESS: Camp Bonneville Range Control Headquarters, Bldg T4398 Vancouver, Washington
C. GENERATOR CONTACT: Steve Hartung
D. GENERATOR EPA ID NO.:
E. GENERATOR STATE ID NO.:
F. GENERATOR STATE WASTE CODE NO.:
G. BILLING NAME: UNIVAR USA, Inc.
H. BILLING ADDRESS: 8201 South 212th Kent, WA 98032
I. BILLING: Linda Wimmer
J. BILLING PHONE NO.: (253) 872-5062
K. GENERATOR PHONE NO.: 360 694 0332
L. VOPAK SALES CONTACT: Christian Jeuris

II. WASTE INFORMATION - PLEASE USE FULL NAMES RATHER THAN

A. NAME OF WASTE STREAM: Decontamination Water
B. DESCRIBE THE PROCESS GENERATING WASTE: Decontaminating Sampling equipment
C. VOLUME: x 10 gallons
D. FREQUENCY: 1 Time
E. SAMPLE SOURCE:
F. WASTE CONTAINER (TRUCK, DRUM, ...): 20 gallon Drum

III. PHYSICAL CHARACTERISTICS OF WASTE STREAM

A. FLASHPOINT: °F
B. pH:
C. DENSITY (#/GAL OR S.G.): n/A
D. COLOR/APPEARANCE: Clear
E. SOLIDS (%): 0%
F. ODOR: n/A - none
G. PHYSICAL STATE: water
H. PHASES/LAYERS: X SINGLE __ MULTIPLE
I. BTU VALUE: n/A

IV. CHEMICAL COMPOSITION-CONSTITUENTS DO NOT USE GENERIC TERMS (e.g. ORGANICS, SALT, SOLIDS, OILS)-ATTACH MSDS FOR PRODUCTS

Constituent	%	ppm	Constituent	%	ppm
H_2O	80-99%		DiNitrile Toluene		4-20 ppm

(* Indicates Tri Listed Chemical) Total % (Must be >= 100%)

V. WASTE CONTENT - PLEASE INDICATE IF THE WASTE CONTAINS ANY OF THE FOLLOWING: (ATTACH ANALYTICAL WHERE APPLICABLE)

SULFIDE ___ ppm	__ YES	X NO	RADIOACTIVE ?	__ YES	X NO	BENZENE NESHAP WASTE? (40 CFR 61 SUBPART FF)	__ YES	X NO
CYANIDE ___ ppm	__ YES	X NO	PCB'S >50 ppm ?	__ YES	X NO	VOC LESS THAN 500 ppmw? (40 CFR 264 SUBPART CC)	__ YES	X NO
BENZENE ___ ppm	__ YES	X NO	PCB TSCA WASTE?	__ YES	X NO	HON WASTEWATER STREAM? (40 CFR 63 SUBPART G)	__ YES	X NO
PESTICIDE/HERBICIDE	__ YES	X NO	DIOXINS ?	__ YES	X NO			
EXPLOSIVE MATERIAL	__ YES	X NO						

VI. RCRA CHARACTERIZATION

A. THIS MATERIAL IS A __ WASTEWATER (<1% TOC AND <1% TSS) X NONWASTEWATER (>=1% TOC AND >=1% TSS)
B. IS THIS A USEPA HAZARDOUS WASTE (40 CFR PART 261)? __ YES X NO State of Texas UNIVERSAL WASTE (30 TAC 335.261)? __ YES X NO
C. IF B IS YES, LIST ALL EPA WASTE CODE NUMBERS (D, F, K, P, U).

VII. ADDITIONAL INFORMATION AND HEALTH & SAFETY PRECAUTIONS

Generator wishes to PROHIBIT management of this waste stream by __ Underground Injection; or __ Subtitle C/D Landfill

Generator waste disposal preference: __ Waste water treatment __ Underground injection __ Incineration __ Landfill (list order of preference 1,2, NO, etc.

VIII. GENERATOR'S CERTIFICATION

SIGNATURE ____ PRINTED (OR TYPED) NAME & TITLE ____ DATE ____

THE SAMPLE SUBMITTED IS REPRESENTATIVE AS DEFINED IN 40CFR261-APPENDIX I. I HEREBY CERTIFY THAT THE ABOVE AND ATTACHED DESCRIPTION IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE AND ABILITY TO DETERMINE THAT NO DELIBERATE OR WILLFUL OMISSIONS OF COMPOSITION OR PROPERTIES EXIST AND THAT ALL KNOWN OR SUSPECTED HAZARDS HAVE BEEN DISCLOSED. I AUTHORIZE VOPAK TO OBTAIN A SAMPLE FROM ANY WASTE SHIPMENT FOR PURPOSES OF RECERTIFICATION

Profile Approval

Profile Temp Univar #: larbw382

NON-HAZARDOUS WASTE MANIFEST	1. Generator's US EPA ID No. WAH000016972	Manifest Doc. No. 50010	2. Page 1 of 1

3. Generator's Name and Mailing Address
CAMP Bonneville - Range Control HEADQUARTERS
BLDG # T4398 VANCOUVER, WA

4. Generator's Phone (360) 694 0332

5. Transporter 1 Company Name	6. US EPA ID Number	A. Transporter's Phone
Rivers Edge Services	WAH000010314	253 8728988
7. Transporter 2 Company Name	8. US EPA ID Number	B. Transporter's Phone
9. Designated Facility Name and Site Address	10. US EPA ID Number	C. Facility's Phone

11. Waste Shipping Name and Description	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol
a. SAMPLING GEAR - SOLID WASTE - RCRA Subtitle D Disposal - non Reg.	003	55	00003	
b.				
c.				
d.				

D. Additional Descriptions for Materials Listed Above

n/A

E. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

n/A

16. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name: Steve Spencer (AGENT) | Signature | Month 06 Day 06 Year 03

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Robert S. Kemp | Signature | Month 06 Day 06 Year 03

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name: Steve Spencer | Signature | Month 06 Day 13 Year 03

GENERATOR / TRANSPORTER / FACILITY

ORIGINAL – RETURN TO GENERATOR

#255090

Emergency Contact Telephone Number

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. WAH.0.0.0.0.1.6.9.7.2 | Manifest Document No. 1.0.0.1.0

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Camp Bonneville - Range Control Headquarters
Build # T-4398

4. Generator's Phone (360) 694 0332

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name: Rivers Edge Services/EMS

6. US EPA ID Number: WA.H.0.00.0.1.0.3.1.4

C. State Transporter's ID

D. Transporter's Phone

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address
Univar USA Inc.
8201 S. 212th
Kent, WA 98032

10. US EPA ID Number: WAD06.754.89.66

G. State Facility's ID

H. Facility's Phone

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number) HM	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. Di-Nitro Toluene Water	0.0.1	1.0	1.0.gal	20lb	
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
N/A

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
N/A

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national governmental regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; **OR**, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: Steve Spencer (Agent) | Signature | Month Day Year: 06 16 03

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Robert S. Kemp | Signature | Month Day Year: 06 16 03

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name | Signature | Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Steve Hibbein | Signature | Month Day Year: 06 30 03

GENERATOR / TRANSPORTER / FACILITY

TRANSPORTER #1

RECYCLING/TSD HANDLING AGREEMENT

Vopak Industrial Services USA Inc.

(GENERATOR AND RECYCLING/TSD CONTRACTOR)

ChemCare

WHEREAS, Generator produces spent chemicals which may be considered to be "hazardous" or "toxic" within the meaning of applicable federal and state laws ("Spent Chemicals") and which therefore must be transported, stored, disposed of, recycled, treated or re-used ("Handled") in accordance with applicable laws pertaining to hazardous or toxic chemicals.

WHEREAS, Recycling/TSD Contractor owns or controls facilities which are capable of Handling spent Chemicals in accordance with all applicable laws pertaining to such activities;

WHEREAS, the parties desire to enter into an arrangement for the Handling of Spent Chemicals, all on the terms and conditions hereinafter set forth;

NOW, THEREFORE, in consideration of the covenants and agreements contained herein, the undersigned agree to the following terms and conditions of this Recycling/TSD Handling Agreement as well as to the Standard Terms and Conditions Governing the Handling of Spent Chemicals ("Standard Terms and Conditions"), which are attached to the Generator copy of this Agreement and are incorporated herein by reference. All capitalized terms not otherwise defined herein shall have the meanings set forth in the Standard Terms and Conditions.

1. **SPENT CHEMICALS SHIPMENT.** The completed Uniform Hazardous Waste Manifest or appropriate state manifest which is identified by the reference number appearing in a space below the signatures to this agreement and which pertains to the Spent Chemicals Shipment Handled under this Agreement is hereby incorporated herein by reference. Such manifest describes certain Spent Chemicals which Generator hereby agrees to ship to Recycling/TSD Contractor and which Recycling/TSD Contractor agrees to handle at the facility named in such manifest ("Designated Facility").

2. **COLLECTION, TRANSPORTATION, STORAGE AND DELIVERY.** All Spent Chemicals Shipments shall be transported to Recycling/TSD Contractor by Univar USA Inc., a Washington Corporation ("Univar USA"), or an entity designated by Univar USA to provide transportation and temporary storage services.

3. **PAYMENT.** It is understood that Univar USA shall pay Recycling/TSD Contractor for Handling the Spent Chemicals Shipment (or, where money is owed to Generator, Univar USA shall pay Generator for the Spent Chemicals Shipment) according to the terms of a certain Master Spent Chemicals Handling Agreement between Recycling/TSD Contractor and Univar USA. Recycling/TSD Contractor shall not look to Generator for payment for Handling the Spent Chemicals Shipment, except for certain extraordinary charges incurred in connection with Non-conforming Spent Chemicals as set forth in the Standard Terms and Conditions.

4. **INDEMNIFIED PARTY.** As used in the Standard Terms and Conditions, the term "Indemnified Party" shall mean either Recycling/TSD Contractor or Generator, depending upon which party claims indemnification under this Agreement.

5. **GENERATOR INDEMNIFICATION.** Generator shall defend, indemnify and hold harmless Recycling/TSD Contractor, its past, present and future officers, directors, employees, agents, insurers, and successors (hereinafter in this Paragraph referred to collectively as "Recycling/TSD Contractor") from and against any and all loss which Recycling/TSD Contractor may sustain or incur, be responsible for or pay out as a result of:

(a) Generator's breach of any representation, warranty, term or provision of this Agreement; or

(b) The negligence or intentional misconduct of Generator, its employees, agents, representatives or subcontractors in the performance of this Agreement, provided that such indemnification shall not apply to the extent such liabilities result from Recycling/TSD Contractor's negligence or intentional misconduct or from a breach of this Agreement by Recycling/TSD Contractor.

6. **NAMES AND ADDRESSES OF PERSONS TO WHOM NOTICE IS TO BE GIVEN.** The name of the person to whom notice is to be given on behalf of Generator appears on the Uniform Hazardous Waste Manifest in Item 16 or the appropriate state manifest. The name of the person to whom notice is to be given on behalf of Recycling/TSD Contractor appears on the Uniform Hazardous Waste manifest in Item 20 or the appropriate state manifest. The addresses of the persons to whom notice is to be given appear on the Uniform Hazardous Waste Manifest under Item 3 (for Generator) and Item 9 (for Recycling/TSD Contractor) or the appropriate state manifest.

RECYCLING/TSD HANDLING AGREEMENT

(GENERATOR AND RECYCLING/TSD CONTRACTOR)

The undersigned hereby agree that, upon execution of this Recycling/TSD Handling Agreement, there is a binding contract between them according to the above terms and conditions, as of the day and year appearing below.

GENERATOR EPA ID# WAH 000016972

FACILITY Camp Bonneville

PRINT NAME: Steve Spence TITLE: AGENT

SIGNATURE: [signature] DATE: 6-30-03

UNIFORM HAZARDOUS WASTE MANIFEST DOCUMENT NUMBER: 1 0 0 1 0

STATE HAZARDOUS WASTE MANIFEST DOCUMENT NUMBER:

RECYCLING/TSD CONTRACTOR:

PRINT NAME: Michael J. Dilick TITLE: Vice President and General Manager

SIGNATURE: [signature]

RECYCLING/TSD CONTRACTOR SHIPMENT APPROVAL NUMBER

VS- 32949 -C

APPENDIX B

MTCA STAT97 REPORTS FOR SMALL ARMS RANGE SOILS

Group 3 >250 Lead Removed

Number of samples		Uncensored values	
Uncensored	378	Mean	20.74
Censored		Lognormal mean	19.98
Detection limit or PQL		Std. devn.	17.6579681
Method detection limit		Median	16.3999996
TOTAL	378	Min.	5.19999981
		Max.	165

Lognormal distribution?		Normal distribution?	
r-squared is:	0.919	r-squared is:	0.528

Recommendations:
Use lognormal distribution.

UCL (Land's method) is 20.9385838326046

UCL (based on Z-statistic) is 22.234

5.2
5.7
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11.3
11.3
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11.4
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11.5

11.5	13.1	15.3	17.8	20.8	26.5

11.5	13.2	15.3	18.0	20.8	26.6
11.5	13.2	15.3	18.1	20.9	26.7
11.5	13.4	15.5	18.1	20.9	27.0
11.5	13.4	15.5	18.1	21.0	27.5
11.6	13.4	15.5	18.1	21.0	27.6
11.6	13.4	15.5	18.1	21.1	27.6
11.7	13.4	15.6	18.1	21.1	27.8
11.7	13.4	15.6	18.2	21.2	28.8
11.7	13.5	15.6	18.2	21.2	29.5
11.8	13.5	15.7	18.4	21.2	29.6
11.9	13.5	15.7	18.5	21.4	30.3
11.9	13.5	15.8	18.5	21.5	30.5
11.9	13.6	15.9	18.6	21.8	31.0
11.9	13.6	15.9	18.7	22.0	31.5
12	13.6	15.9	18.7	22.0	31.7
12	13.6	15.9	18.8	22.0	31.8
12	13.7	15.9	18.8	22.1	32.9
12	13.8	16.0	18.8	22.1	33.1
12	13.8	16.0	18.8	22.1	33.3
12	13.9	16.1	18.9	22.2	34.9
12	14	16.1	18.9	22.5	35.5
12	14	16.1	18.9	22.5	35.5
12.1	14.1	16.2	18.9	22.7	36.4
12.1	14.1	16.3	19.0	22.7	37.8
12.1	14.1	16.3	19.0	22.8	38.3
12.2	14.2	16.4	19.1	22.9	38.3
12.2	14.2	16.4	19.2	22.9	39.2
12.2	14.2	16.4	19.3	22.9	39.3
12.3	14.2	16.5	19.4	23.0	39.5
12.3	14.2	16.5	19.5	23.2	39.6
12.3	14.3	16.6	19.5	23.2	40.9
12.3	14.3	16.7	19.5	23.3	42.4
12.4	14.4	16.8	19.5	23.3	43.0
12.5	14.4	16.8	19.6	23.6	44.6
12.5	14.4	16.8	19.6	23.6	46.1
12.6	14.4	16.9	19.6	23.6	50.2
12.7	14.4	16.9	19.8	23.7	52.2
12.7	14.4	16.9	19.8	23.8	53.2
12.7	14.5	17.0	19.8	24.1	54.0
12.8	14.5	17.0	19.9	24.1	54.7
12.8	14.5	17.1	20.0	24.1	58.5
12.9	14.6	17.2	20.0	24.2	59.1
12.9	14.6	17.2	20.1	24.4	62.8
12.9	14.7	17.2	20.1	24.6	63.4
12.9	14.8	17.5	20.2	25.2	72.8
12.9	14.9	17.5	20.3	25.3	81.0
12.9	14.9	17.6	20.3	25.4	81.8
12.9	14.9	17.7	20.4	25.5	86.2
13.1	15	17.7	20.5	25.7	107.0
13.1	15	17.8	20.5	25.9	116.0
13.1	15.1	17.8	20.5	25.9	135.0
13.1	15.2	17.8	20.6	26.0	158.0
13.1	15.2	17.8	20.7	26.4	165.0

Group 4 - >250 Lead Removed

Number of samples		Uncensored values	
Uncensored	415	Mean	21.03
Censored		Lognormal mean	18.96
Detection limit or PQL		Std. devn.	27.7480999
Method detection limit		Median	12.6000004
TOTAL	415	Min.	4.69999981
		Max.	238

Lognormal distribution?		Normal distribution?	
r-squared is:	0.857	r-squared is:	0.465

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (Land's method) is 20.1878253505537

UCL (based on Z-statistic) is 23.275

4.7
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4.9
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5.2
5.2
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5.6
5.7
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5.9
6.1
6.6
6.6
6.7
6.8
7.2
7.2
7.4
7.4
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7.5
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7.6
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7.9
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8.1
8.1
8.1
8.2
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8.2
8.3
8.4
8.5
8.5
8.5
8.5
8.5
8.5
8.7
8.7
8.7

10.3	11.5	12.9	14.6	19.9	43.6	

8.8	10.3	11.5	12.9	14.7	19.9	44.3
8.8	10.3	11.6	12.9	14.8	20.3	44.9
8.8	10.4	11.6	12.9	14.8	20.5	45.3
8.8	10.4	11.6	12.9	15.1	20.5	45.4
8.8	10.4	11.6	12.9	15.2	20.5	47.6
8.8	10.4	11.6	13	15.2	20.7	49.1
8.9	10.5	11.7	13	15.4	20.8	51.0
8.9	10.5	11.7	13	15.4	21.0	51.3
8.9	10.5	11.8	13.2	15.4	21.0	55.2
8.9	10.5	11.8	13.2	15.5	21.5	61.0
9	10.5	11.9	13.2	15.5	22.7	62.1
9	10.5	11.9	13.2	15.6	22.7	64.0
9.1	10.5	11.9	13.3	15.7	22.8	64.3
9.1	10.5	11.9	13.3	15.7	22.9	66.6
9.1	10.6	11.9	13.3	15.8	23.0	75.3
9.1	10.6	11.9	13.4	15.9	23.2	76.5
9.1	10.7	11.9	13.4	15.9	23.6	77.5
9.3	10.7	11.9	13.5	16.1	23.6	78.4
9.3	10.7	11.9	13.5	16.1	23.8	84.5
9.3	10.7	12.0	13.6	16.2	23.9	85.9
9.3	10.8	12.0	13.6	16.2	24.3	88.2
9.4	10.9	12.0	13.6	16.2	24.7	90.3
9.5	10.9	12.0	13.6	16.3	24.8	94.9
9.5	10.9	12.0	13.6	16.6	25.0	105.0
9.5	10.9	12.1	13.7	16.6	25.1	105.0
9.6	10.9	12.1	13.7	16.8	25.2	107.0
9.6	11	12.1	13.8	16.9	25.3	114.0
9.6	11	12.1	13.8	17.0	25.5	116.0
9.7	11	12.1	13.8	17.1	25.5	120.0
9.7	11	12.2	13.8	17.2	25.9	126.0
9.7	11	12.2	13.8	17.2	26.0	150.0
9.7	11.1	12.3	13.8	17.5	26.3	151.0
9.8	11.1	12.3	13.8	17.5	27.0	163.0
9.8	11.1	12.3	13.8	17.7	27.3	204.0
9.9	11.2	12.4	13.9	17.8	28.5	214.0
9.9	11.2	12.4	13.9	17.9	29.3	238.0
9.9	11.2	12.4	14	18.2	30.6	
10	11.2	12.4	14	18.2	31.1	
10	11.2	12.4	14.1	18.2	31.6	
10	11.3	12.5	14.1	18.2	31.7	
10	11.3	12.5	14.1	18.3	31.7	
10	11.3	12.5	14.1	18.5	31.7	
10.1	11.3	12.5	14.1	18.5	32.8	
10.1	11.3	12.6	14.2	18.5	33.7	
10.1	11.4	12.6	14.2	18.6	33.8	
10.2	11.4	12.6	14.3	18.9	33.9	
10.2	11.4	12.6	14.3	19.0	34.6	
10.2	11.4	12.7	14.4	19.0	37.6	
10.3	11.4	12.7	14.5	19.1	37.6	
10.3	11.5	12.7	14.5	19.1	38.2	
10.3	11.5	12.8	14.5	19.2	40.4	
10.3	11.5	12.8	14.6	19.3	41.5	
10.3	11.5	12.8	14.6	19.5	42.7	

Machine Gun Range South - > 250 Lead Removed

5.2
6.9
6.9
6.9
7.4
7.7
8
8
8.5
8.8
8.9
9.1
9.8
9.8
9.8
9.9
10
10.3
10.3
10.3
10.3
10.6
10.6
10.7
10.7
10.7
10.7
10.9
11.4
11.4
11.5
11.5
11.5
11.6
11.7
11.8
11.9
11.9
12
12
12
12
12.1
12.1
12.3
12.4
12.7
12.7
12.9
12.9
12.9
12.9
12.9
13.1
13.1

Number of samples		Uncensored values	
Uncensored	129	Mean	16.04
Censored		Lognormal mean	15.55
Detection limit or PQL		Std. devn.	12.9330398
Method detection limit		Median	14
TOTAL	129	Min.	5.19999981
		Max.	135

Lognormal distribution?		Normal distribution?	
r-squared is:	0.867	r-squared is:	0.373

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (Land's method) is 16.5643266887895

UCL (based on Z-statistic) is 17.913

13.1
13.1
13.1
13.4
13.4
13.5
13.5
13.6
13.8
14
14
14.1
14.2
14.2
14.3
14.4
14.4
14.5
14.5
14.5
14.6
14.6
14.8
14.9
14.9
15
15
15.2
15.6
15.9
16.1
16.3
16.4
16.4
16.5
16.9
16.9
17
17.2
17.7
17.8
18.1
18.1
18.1
18.2
18.5
18.6
18.8
18.8
18.9
19
19.1
19.2
19.4
19.5

19.5
19.6
19.9
20.1
20.4
20.9
20.9
21.1
21.2
21.8
22
24.1
24.1
27
27.8
28.8
31.5
81
135

Rifle Ranges 1 & 2 - >250 Lead Removed

Number of samples		Uncensored values	
Uncensored	151	Mean	33.32
Censored		Lognormal mean	31.30
Detection limit or PQL		Std. devn.	41.8520645
Method detection limit		Median	17.3999996
TOTAL	151	Min.	3.59999991
		Max.	220

Lognormal distribution?
r-squared is:

Normal distribution?
r-squared is:

Recommendations:
Assume lognormal distribution.
Y value is -2.2239. This lies within the tabled values of 1.4245 and -2.4508

UCL (Land's method) is 36.6605627538411

3.6
3.7
3.9
4.5
4.7
4.9
5
5.3
5.6
5.6
5.8
5.8
5.9
6.4
6.5
6.7
6.8
6.9
7.4
7.9
8.1
8.3
8.7
9
9.3
9.5
9.6
10.1
10.3
10.5
10.5
10.5
10.7
10.7
11
11.1
11.2
11.2
11.2
11.3
11.3
11.4
11.7
11.8
12
12.2
12.5
12.5
13.2
13.6
14
14
14.2
14.2
14.2

14.4
14.5
15.1
15.2
15.3
15.5
15.5
15.6
15.6
15.6
16.1
16.2
16.2
16.3
16.4
17
17
17.1
17.2
17.3
17.4
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17.8
18.4
18.7
18.9
18.9
19.1
19.2
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19.3
19.3
19.5
21.1
21.2
21.3
21.3
21.6
21.6
21.9
22.4
22.5
22.7
23
23
24.2
24.4
24.6
25
25.4
25.5
25.9
26
27.9
29.2

29.6
31.4
31.8
32.8
32.9
34.4
34.8
35.4
36
37.3
39.4
41.8
49.3
51.3
51.6
52.1
52.8
55.8
59.1
65
67
69.9
74.8
80.7
82.4
87.6
92.3
94.5
95.8
96.8
108
108
130
132
137
145
172
180
199
212
220

25m & Machine Gun Range > 250 Lead Removed

Number of samples		Uncensored values	
Uncensored	58	Mean	42.40
Censored		Lognormal mean	42.03
Detection limit or PQL		Std. devn.	44.4044253
Method detection limit		Median	26.25
TOTAL	58	Min.	5.5
		Max.	214

Lognormal distribution?		Normal distribution?	
r-squared is:	0.983	r-squared is:	0.726

Recommendations:
Use lognormal distribution.

UCL (Land's method) is 54.4761628977016

UCL (based on Z-statistic) is 51.991

5.5
5.7
6.1
7.6
9.6
9.8
10.6
10.8
10.9
11
11.4
12
12.2
13
13.7
13.8
14.6
16.2
17.2
17.2
18.2
19
19.1
22.7
24.7
25
25.1
25.2
25.5
27
28.5
29.3
31.1
31.6
31.7
33.8
37.6
37.6
38.2
40.4
42.7
43.6
45.4
49.1
61
62.1
64
64.3
66.6
75.3
85.9
105
114
116
120

126
204
214

25m Record Fire Field Range >250 Lead Removed

Number of samples		Uncensored values	
Uncensored	197	Mean	20.25
Censored		Lognormal mean	18.30
Detection limit or PQL		Std. devn.	26.7507268
Method detection limit		Median	12.3000002
TOTAL	197	Min.	4.80000019
		Max.	238

Lognormal distribution?		Normal distribution?	
r-squared is:	0.844	r-squared is:	0.443

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (Land's method) is 20.0004986830309

UCL (based on Z-statistic) is 23.388

4.8
5.2
5.4
5.9
6.6
6.7
6.8
7.2
7.2
7.4
7.4
7.5
7.6
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7.7
7.7
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8.1
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9.1
9.1
9.1
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10.1
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13.8
13.8
13.9
13.9
14
14.1
14.1
14.2
14.3
14.4
14.8
15.2
15.2
15.7
15.9
16.2
16.3
17.5
18.2
18.5
18.5
18.6
19
19.2
19.3
19.5
19.9
19.9
20.5
20.8
21
21
21.5
22.7
22.8
22.9
23
23.2
23.6
23.8

24.3
24.8
25.3
25.5
25.9
26
26.3
27.3
30.6
31.7
31.7
32.8
33.7
33.9
34.6
41.5
44.3
44.9
45.3
51
55.2
76.5
77.5
78.4
84.5
88.2
90.3
94.9
107
150
163
238

1,000' Range, 1000' Machine Gun Range - 250 Lead Removed

Number of samples		Uncensored values	
Uncensored	137	Mean	35.29
Censored		Lognormal mean	31.80
Detection limit or PQL		Std. devn.	46.7799078
Method detection limit		Median	15.3000002
TOTAL	137	Min.	4.69999981
		Max.	241

Lognormal distribution?		Normal distribution?	
r-squared is:	0.884	r-squared is:	0.602

Recommendations:

Reject lognormal distribution.

Y value is -6.6098. This lies outside the tabled values of 1.3918 and -2.478

Reject normal distribution.

Y value is -29.3375. This lies outside the tabled values of 1.3918 and -2.478

UCL (Land's method) is 37.3928809833088

UCL (based on Z-statistic) is 41.866

4.7				
4.8				
4.9				
6.2				
6.3				
7.4				
7.5				
7.5				
7.8				
8.8				
9.1				
9.3				
9.3				
9.4				
9.7				
9.9				
9.9				
10				
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10				
10				
10.1				
10.1				
10.4				
10.4				
10.8				
10.9				
11.3				
11.4				
11.4				
11.5				
11.5	13.9	16.6	26.6	106.0
11.6	14.2	16.7	28.1	109.0
11.7	14.3	17.0	28.2	115.0
11.7	14.3	17.2	29.8	115.0
11.9	14.5	17.4	30.1	120.0
11.9	14.8	17.4	32.2	128.0
12.1	14.8	18.6	39.1	136.0
12.2	14.9	19.2	39.6	146.0
12.3	15	19.6	45.0	170.0
12.4	15.1	19.8	48.3	172.0
12.4	15.2	20.1	49.6	198.0
12.5	15.2	20.6	51.9	210.0
12.6	15.2	21.2	55.8	216.0
12.6	15.3	21.5	56.7	241.0
12.7	15.3	22.1	58.0	
13.1	15.5	22.6	63.3	
13.3	15.5	22.8	63.4	
13.4	15.5	22.8	63.7	
13.5	16	22.9	68.5	
13.6	16	24.8	90.7	
13.7	16.4	25.0	91.7	
13.8	16.5	25.3	96.4	
13.8	16.6	25.5	98.4	

Combat Pistol Range - >250 Lead Removed

Number of samples		Uncensored values	
Uncensored	84	Mean	23.23
Censored		Lognormal mean	22.07
Detection limit or PQL		Std. devn.	22.371283
Method detection limit		Median	16.25
TOTAL	84	Min.	8.69999981
		Max.	165

Lognormal distribution?		Normal distribution?	
r-squared is:	0.879	r-squared is:	0.515

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (Land's method) is 24.7481712413549

UCL (based on Z-statistic) is 27.243

8.7
9.2
9.3
9.5
10.1
10.2
11
11.2
11.3
11.3
11.4
11.5
11.5
12
12
12.2
12.2
12.3
12.3
12.5
12.6
12.7
12.8
13.1
13.4
13.5
14.1
14.2
14.3
14.4
14.4
14.9
15.2
15.3
15.5
15.5
15.7
15.9
15.9
15.9
16
16.2
16.3
16.4
16.7
16.8
16.9
17
17.2
17.2
17.7
18.1
19.5
19.8
20.3

20.5
20.5
21.4
22.2
22.9
23.2
23.3
23.8
24.1
24.2
25.3
27.6
27.6
29.5
29.6
31.7
33.1
33.3
35.5
35.5
39.3
39.5
43
46.1
54
58.5
81.8
116
165

Field Fire Ranges 1 & 2 & Pistol - 250 Lead Removed

Number of samples		Uncensored values	
Uncensored	66	Mean	23.44
Censored		Lognormal mean	20.18
Detection limit or PQL		Std. devn.	34.661875
Method detection limit		Median	13.0500002
TOTAL	66	Min.	5.80000019
		Max.	187

Lognormal distribution?	Normal distribution?
r-squared is:	r-squared is:

Recommendations:
Reject lognormal distribution.
Y value is -12.7266. This lies outside the tabled values of 1.1516 and -2.6708
Reject normal distribution.
Y value is -31.3655. This lies outside the tabled values of 1.1516 and -2.6708

UCL (Land's method) is 24.2061713645749

UCL (based on Z-statistic) is 30.462

5.8
6.9
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13.1
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13.9
14.8
15.2
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17.1
17.2
17.7
18.7
19.6
20.3
20.3

20.4
21
24.6
25.9
49
58.5
68.1
125
136
154
187

Field Fire Rifle Range 1 & 2 - >250 Lead Removed

4.4
4.6
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11.7
12.3
13.4
13.5
13.9
14.2

Number of samples		Uncensored values	
Uncensored	109	Mean	23.07
Censored		Lognormal mean	22.10
Detection limit or PQL		Std. devn.	24.450883
Method detection limit		Median	14.1999998
TOTAL	109	Min.	4.4000001
		Max.	149

Lognormal distribution? Normal distribution?
r-squared is: r-squared is:

Recommendations:
Assume lognormal distribution.
Y value is -0.8166. This lies within the tabled values of 1.3246 and -2.534

UCL (Land's method) is 25.8599201911779

14.6
14.9
15
15.2
15.2
15.4
16.2
16.8
17.1
17.5
17.7
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18.7
18.7
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19.1
19.6
20.6
20.8
22.5
23.1
23.6
23.6
23.6
23.7
23.8
24.7
25.9
26.2
28.2
29.3
29.4
29.8
32.3
35.6
37
38.8
44.4
47.3
47.4
48.8
52.3
52.6
53.3
59.1
61
62.4
69.3
69.9
78.5
95.4
97
114
149

Group 1 >250 Lead Removed

Number of samples		Uncensored values	
Uncensored	366	Mean	23.43
Censored		Lognormal mean	21.07
Detection limit or PQL		Std. devn.	31.8831872
Method detection limit		Median	14.1999998
TOTAL	366	Min.	3.59999991
		Max.	220

Lognormal distribution?		Normal distribution?	
r-squared is:	0.903	r-squared is:	0.492

Recommendations:
Use lognormal distribution.

UCL (Land's method) is 22.7256876090203

UCL (based on Z-statistic) is 26.169

3.6					
3.7					
3.9					
4.4					
4.5					
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8.7					
8.7					
8.7	10.7	12.7	16.1	19.6	35.4

8.8	10.7	12.8	16.2	19.7	36.0
8.9	10.7	12.9	16.2	19.8	37.2
8.9	10.8	12.9	16.3	19.8	37.3
9	10.9	12.9	16.3	20.1	39.4
9	10.9	12.9	16.3	20.4	41.8
9	10.9	13.1	16.3	21.1	44.9
9	10.9	13.2	16.4	21.1	49.3
9	10.9	13.4	16.4	21.1	51.3
9.1	10.9	13.6	16.4	21.2	51.6
9.1	11	13.7	16.5	21.3	52.1
9.2	11.1	13.7	16.5	21.3	52.8
9.2	11.1	13.7	16.7	21.4	55.8
9.2	11.2	13.8	16.7	21.6	59.1
9.2	11.2	13.8	16.8	21.6	64.6
9.3	11.2	14.0	16.9	21.7	65.0
9.3	11.2	14.0	17.0	21.7	67.0
9.3	11.3	14.0	17.0	21.8	68.3
9.3	11.3	14.1	17.1	21.9	69.9
9.4	11.3	14.2	17.2	21.9	74.8
9.4	11.4	14.2	17.2	22.2	80.7
9.4	11.4	14.2	17.2	22.2	82.4
9.4	11.5	14.2	17.3	22.4	87.6
9.4	11.6	14.2	17.4	22.5	88.3
9.4	11.6	14.4	17.5	22.7	92.3
9.5	11.6	14.4	17.5	23.0	94.5
9.5	11.6	14.5	17.6	23.0	95.8
9.6	11.7	14.5	17.6	23.4	96.8
9.6	11.7	14.5	17.7	23.4	108.0
9.7	11.7	14.6	17.8	23.7	108.0
9.8	11.7	14.9	18.0	23.9	108.0
9.8	11.7	15.0	18.2	24.2	130.0
9.9	11.8	15.1	18.2	24.4	132.0
10	11.8	15.1	18.3	24.6	136.0
10	11.9	15.2	18.4	24.8	137.0
10	12	15.2	18.4	25.0	145.0
10.1	12	15.3	18.4	25.4	172.0
10.2	12	15.3	18.6	25.5	180.0
10.2	12.1	15.4	18.7	25.9	199.0
10.2	12.1	15.4	18.7	26.0	212.0
10.3	12.2	15.4	18.8	27.9	219.0
10.3	12.2	15.5	18.9	29.2	220.0
10.3	12.2	15.5	18.9	29.6	
10.3	12.3	15.5	19.0	29.9	
10.4	12.3	15.6	19.1	30.2	
10.4	12.4	15.6	19.1	31.4	
10.5	12.4	15.6	19.2	31.8	
10.5	12.5	15.7	19.2	32.8	
10.5	12.5	15.7	19.2	32.9	
10.5	12.5	15.9	19.3	33.7	
10.5	12.5	16.0	19.3	34.4	
10.6	12.5	16.0	19.4	34.6	
10.6	12.6	16.0	19.5	34.8	
10.7	12.6	16.1	19.5	35.3	

Group 2 >250 Lead Removed

Number of samples		Uncensored values	
Uncensored	337	Mean	28.28
Censored		Lognormal mean	25.52
Detection limit or PQL		Std. devn.	37.6205567
Method detection limit		Median	14.6000004
TOTAL	337	Min.	3.70000005
		Max.	241

Lognormal distribution?		Normal distribution?	
r-squared is:	0.911	r-squared is:	0.570

Recommendations:
Use lognormal distribution.

UCL (Land's method) is 27.9721571736205

UCL (based on Z-statistic) is 31.653

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9
9

9.1	11.4	14.2	18.7	29.8	136

9.1	11.5	14.2	18.7	29.8	136
9.2	11.5	14.3	18.7	30.1	146
9.2	11.5	14.3	19.0	32.2	149
9.2	11.5	14.3	19.1	32.3	154
9.3	11.6	14.5	19.2	34.6	154
9.3	11.7	14.6	19.4	35.6	170
9.3	11.7	14.8	19.6	37.0	172
9.4	11.7	14.8	19.6	38.8	187
9.4	11.7	14.8	19.6	39.1	198
9.4	11.7	14.9	19.8	39.6	210
9.4	11.8	14.9	20.1	44.1	216
9.6	11.9	15.0	20.1	44.4	241
9.7	11.9	15.0	20.3	45.0	
9.9	11.9	15.1	20.3	47.3	
9.9	11.9	15.2	20.4	47.4	
9.9	12.1	15.2	20.6	48.3	
9.9	12.1	15.2	20.6	48.8	
10	12.1	15.2	20.8	49.0	
10	12.2	15.2	21.0	49.6	
10	12.3	15.2	21.2	51.9	
10	12.3	15.3	21.5	52.3	
10	12.4	15.3	21.8	52.6	
10.1	12.4	15.3	22.1	53.3	
10.1	12.5	15.4	22.4	55.8	
10.1	12.6	15.4	22.5	56.7	
10.1	12.6	15.5	22.6	58.0	
10.2	12.7	15.5	22.6	58.5	
10.2	12.7	15.5	22.8	59.1	
10.4	12.9	15.8	22.8	61.0	
10.4	13	16.0	22.9	62.4	
10.4	13.1	16.0	23.1	63.3	
10.4	13.1	16.0	23.6	63.4	
10.5	13.1	16.0	23.6	63.7	
10.6	13.3	16.2	23.6	68.1	
10.6	13.4	16.4	23.7	68.5	
10.7	13.4	16.5	23.8	69.3	
10.7	13.5	16.6	24.6	69.9	
10.7	13.5	16.6	24.6	78.5	
10.7	13.5	16.7	24.7	86.0	
10.8	13.6	16.8	24.8	90.7	
10.8	13.6	17.0	25.0	91.7	
10.9	13.6	17.1	25.3	95.4	
10.9	13.7	17.1	25.5	96.4	
11	13.7	17.2	25.9	97.0	
11.1	13.8	17.2	25.9	98.4	
11.2	13.8	17.4	26.2	106.0	
11.2	13.8	17.4	26.6	109.0	
11.2	13.8	17.5	27.0	114.0	
11.2	13.9	17.7	28.1	115.0	
11.2	13.9	17.7	28.2	115.0	
11.3	13.9	17.7	28.2	120.0	
11.4	13.9	18.5	29.3	125.0	
11.4	14.2	18.6	29.4	128.0	

CD